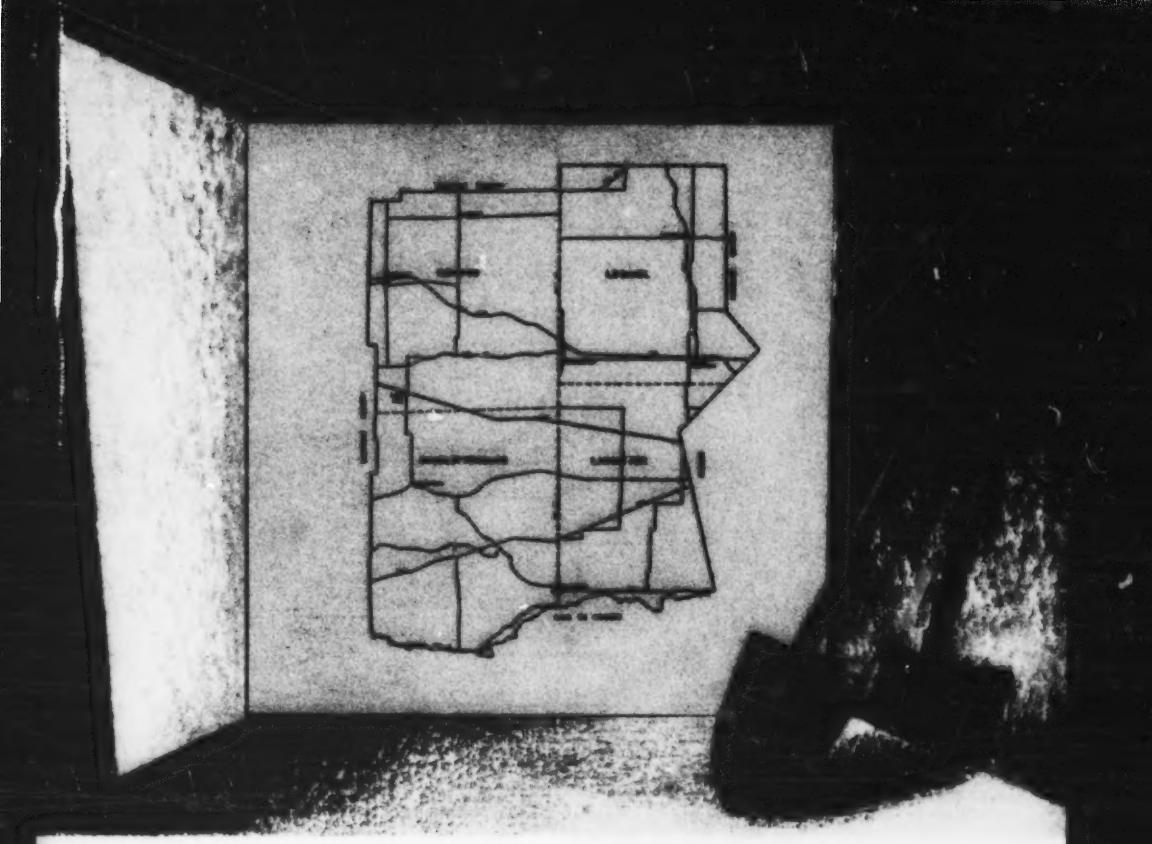

SOIL SURVEY OF GLENGARRY COUNTY

REPORT No. 24 OF THE ONTARIO SOIL SURVEY

Prepared jointly by The Experimental Farm Service, Agriculture Canada, and the Ontario Agricultural College

Ontario
Ministry of Agriculture and Food
Agriculture Canada
Research Branch
Direction générale de la recherche

91-05022/

SOIL SURVEY of GLENGARRY COUNTY

by

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and

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GUELPH

May, 1957

(Reprinted October 1990)

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FIG. 1. Outline map of Ontario showing location of Glengarry County and other areas for which soil maps and reports have been published.

ACKNOWLEDGMENTS

The Canada Department of Mines and Technical Surveys, Surveys and Mapping Branch, supplied the base maps. The final copy of the soil map was prepared for lithographing by the Cartographic Section of the Division of Field Husbandry, Soils and Agricultural Engineering, Central Experimental Farm, Ottawa.

The preliminary field survey was conducted by Mr. D. D. Dolson.

Dr. P. C. Stobbe, Canada Department of Agriculture, assisted with the classification and correlation in the field and critically reviewed the manuscript. Much valuable assistance was provided by Dr. A. Leahey, Canada Department of Agriculture, during the course of this project.

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Soil Survey of Glengarry County

by

B. C. Matthews, N. R. Richards *and* R. E. Wicklund

INTRODUCTION

The primary purpose of a soil survey is to classify and describe the soils of an area. Such features as colour, structure, texture, thickness, and number of horizons as well as some chemical characteristics are described for the different soils. Finally, some recommendations for land use are suggested. In seeking information regarding the soils of the area, reference should be made to the map as well as to the report. A total of twenty-eight soil types and phases occur in Glengarry County. This report and map point out the location of the different soils and indicate their crop adaptabilities and management requirements.

The Map — The soil map that is contained in the pocket at the back of the report presents all the important geographic features of the County such as cities, towns, railways, roads, post-offices, lakes, and rivers as well as the distribution of the soils. The areas of different soils are delineated by solid black lines and the soil types are identified on the map by the use of colours, letter combinations and symbols, the key for which appears on the map sheet. In using the map it must be kept in mind that the scale of the map (1 inch = 1 mile) prevents the presentation of sufficient detail to show soil variations of less than twenty-five acres in extent. However, the map and report, when properly used, can furnish valuable basic information for estimating the productivity and land use problems even within rather limited areas.

The Report — The report is divided into several sections as listed in the table of contents. Several tables of statistics in the text and in the appendix are presented to support statements made in the text of the report.

How to Use the Soil Survey Report

The individual reader may be interested in the whole report or only in some particular part. Ordinarily he will be able to obtain the information he needs without reading the whole report. The report is designed to meet the needs of three general groups of readers: (1) those interested in the County as a whole, (2) farmers and others interested in specific parts of the County such as a farm or concession and (3) students and teachers of soil science and related sciences.

Readers interested in the area as a whole include those concerned with agricultural advisory work, the location and development of urban centres, industries, highways, community co-operatives, processing plants and areas for forestry, wildlife, and recreation. Such persons should read the sections entitled *General Description of the Area,* in which location, organization, population, industries, transportation and markets are discussed, *Soil Problems in Glengarry County* in which physiography, relief and drainage, climate, and soil use problems are discussed, and *Land Use and Soil Management* in which soil improvement practices are suggested.

Readers interested in specific areas, i.e. a farm, or field, or group of farms, include farmers, agricultural fieldmen, prospective land buyers, realtors, tax assessors and

land appraisers. These readers should (1) locate on the map the tract of land with which they are concerned, (2) identify the soils in the tract by locating the appropriate symbol and colour in the legend on the map, and (3) read the descriptions of the specific soils in the section of the report entitled, *Description of Soils*. In this section each soil is described in detail and its suitability for use is discussed. Useful information will also be found in the section on *Land Use and Management*.

Students and teachers of soil science will find valuable information in the section on *Factors Affecting Soil Genesis in Glengarry County*. The *Summary of the Classification of the Soils of Glengarry County* along with the section on *Description of Soils* provides basic information for soil classification.

HOW SOILS ARE CLASSIFIED

The development of a soil from unweathered broken rock is an intriguing story. Under the influence of the vegetation, climate, and drainage acting on the raw soil material, called parent material, different soil layers develop over a period of time. Accordingly in a vertical cut through the soil, two or more layers or horizons may be observed above the grey parent material. The different soil horizons from the surface down to the parent material make up the soil profile.

Entire Soil Profile is Important

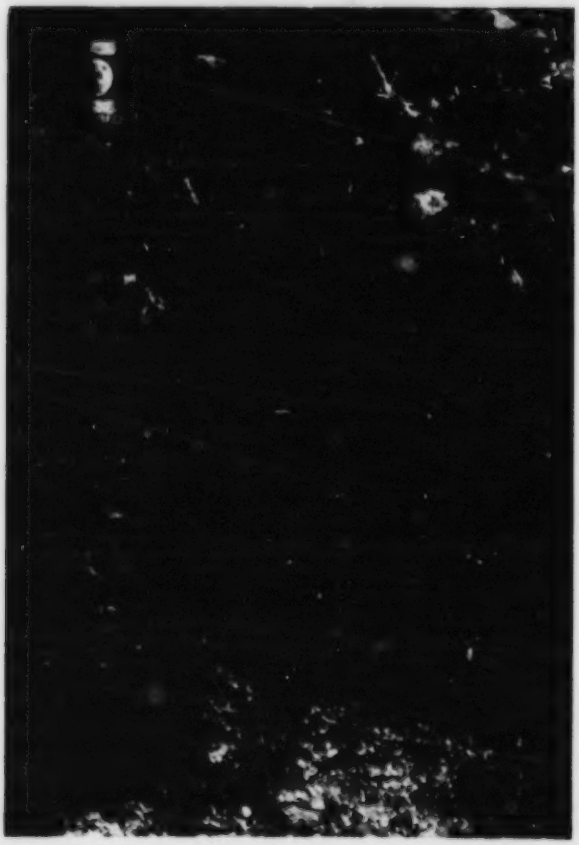
The entire soil profile must be considered in estimating the productivity of a given soil. Two soils, for instance, may have similar surface layers but one may have a compact subsoil that restricts water movement and root penetration, while the other may have an open porous subsoil that permits rapid water movement and easy root penetration.

In classifying soils, therefore, the entire soil profile is considered. In Glengarry County, twenty-eight different soils have been recognized and delineated on the map. These soils differ from one another in one or more of the following features of the soil profile; number, colour, thickness, texture, structure, and chemical composition of the different horizons.

In any given area of Glengarry County, there are two major groups of soil profiles — the well drained and imperfectly drained group, and the poorly drained group. In the well drained and imperfectly drained locations, the general appearance of the profiles differs greatly from place to place. Indeed, the best drained soils are the keys to the understanding of any given association of soils.

Well Drained Soil Profiles

Differences among well drained soils can be observed in different parts of the County. Because the climatic conditions and vegetation do not vary significantly within the County the observable differences in the well drained profiles can usually be related to the parent materials, especially to the lime content. In Glengarry County, there are three major great groups of well drained profiles, namely Brown Forest, Grey-Brown Podzolic, and Podzol. In addition, there are Ground-water Podzol soils (see Castor series description) and Organic soils (see Belmeade and Muck series descriptions).



Soils of Brown Forest Great Soil Group have Shallow Profiles and a Brownish Colour in the Subsoil.

The following is a description of a soil profile that represents the Brown Forest Great Soil Group in Glengarry County:

A_0 — ¼–0 inches of matted leaf litter.

A_1 — 0–5 inches of very dark grey loam; friable; medium crumb structure; few stones; medium to high in organic matter; pH — 7.0

B_1 — 5–10 inches of grey-brown loam; friable; fine nuciform structure; few stones; free carbonates may be present; pH — 7.0

B_2 — 10–18 inches of very dark grey-brown loam; friable; medium nuciform structure; stones and boulders; free carbonates may be present; pH — 7.2

A Grey-Brown Podzolic Soil Profile

C_1 — 18–23 inches of grey-brown loam; friable; very weak fine nuciform structure; stony calcareous; pH — 7.6

C_2 — Grey or grey-brown loamy calcareous till; stony; somewhat compacted; pH — 8.0

On a well drained site, where lime has been partially lost from the soil material (or where the material had only a medium lime content originally), the kind of profile that commonly occurs belongs to the Grey-Brown Podzolic Great Soil Group. The Kars gravelly sandy loam as described below is a good example of such a soil:

A_0 — ½–0 inches of leaf litter.

A_1 — 0–4 inches of dark grey-brown sandy loam; very fine crumb to single grain structure; few stones; pH — 6.8

A Podzol Soil Profile

A_2 — 4–12 inches of yellow-brown sandy loam; single grain structure; few stones; pH — 6.7

B — 12–20 inches of dark brown loam or sandy loam; small nuciform structure; few stones; pH — 7.0

C — Rough unsorted gravel and sand; low in carbonates; stony; some boulders; pH — 7.0

In well drained positions on materials that were originally low in lime or are so open in texture that leaching has rapidly removed the lime, a profile representative of the Podzo. Great Soil Group has developed. The following is a description of a profile showing the characteristics of the Podzol group in Glengarry County:

A_0 — 1–0 inch of litter of twigs and needles.

Note dark grey surface soil and grey mottled subsoil of Dark Grey Gleisolic Soil

A_2 — 0–2 inches of grey sand; extremely friable; single grain structure; pH — 5.8

B_2 — 2–15 inches of dark brown sand; friable; single grain to very fine nuciform structure; pH — 6.4

C_1 — 15–22 inches of brownish yellow sand; friable; single grain structure; pH — 6.4

C_2 — Grey sand and gravel; non-calcareous; pH — 6.6

Poorly Drained Soil Profiles

In close association with each well drained profile, imperfectly drained and poorly drained profiles often occur on the lower slopes and in depressions. The imperfectly drained profiles exhibit the same kinds of horizons as the well drained profiles but the B horizon is mottled brown and reddish brown rather than a uniform

colour. The poorly drained soils, however, have a completely different set of horizons and are called "glei soils".

Commonly, the restricted drainage has far outweighed all other factors of soil development so that the same general kind of profile occurs in the poorly drained locations throughout the County. The poorly drained soils of Glengarry County are classified in the Dark Grey Gleisolic Great Soil Group. A description of a fine textured Dark Grey Gleisolic soil profile found in the County is presented below:

A_0 — ½–0 inches of matted leaf litter.

A_1 — 0–6 inches of very dark brown clay; friable consistency; crumb structure; high in organic matter which is well incorporated with the mineral fraction; no free carbonates; pH — 6.8

G_1 — 6–10 inches of grey clay; mottled with rusty brown; plastic consistency; massive structure; pH — 7.0

G_2 — 10–30 inches of mottled rusty brown and grey clay; extremely plastic; massive or very coarse blocky structure; no free carbonates; pH — 7.2

C — Grey clay; massive; plastic; pH — 7.2

The mottling that is evident in the G (glei) horizon is indicative of a fluctuating water table and the consequent alternate oxidation and reduction of the iron. In very poorly drained soils, the A horizon is mucky and the G horizons are more uniform drab grey colour. Such soils are included in the Organic Great Soil Group.

The differences in soils that are due to differences in drainage are usually observable within field or farm boundaries. Well drained, imperfectly drained, and poorly drained soils occur in close geographical association, so it is convenient to use the term "catena" to designate two or more soil series developed on similar parent material but differing in drainage.

Soil Type and Soil Series

The principal unit of soil mapping is the soil type. The soil type consists of a group of soils with profiles having similar genetic horizons, developed from similar parent material.

In using the map, it is important to keep in mind that a given soil type may include a limited range in properties. The boundaries between soil types vary in sharpness. Between two soil types in the field there is a zone that includes some of the features of each type. Also within a given type, there are often discrete areas of other types too small to be shown on the soil map.

Soil types do not occur at random, nor is their nature a matter of chance. The factors that have determined soil type differences in Glengarry County are discussed in Part II. If one knows the conditions under which a given soil type has developed, he will be able to obtain from the soil map a picture not only of the present character of the soil but also of the slope of the area where it occurs, the native vegetation, drainage, and other factors that have affected its formation.

Two or more soil types developed on similar parent material, under similar drainage conditions, but differing in texture of the surface horizon are grouped together as a Soil Series.

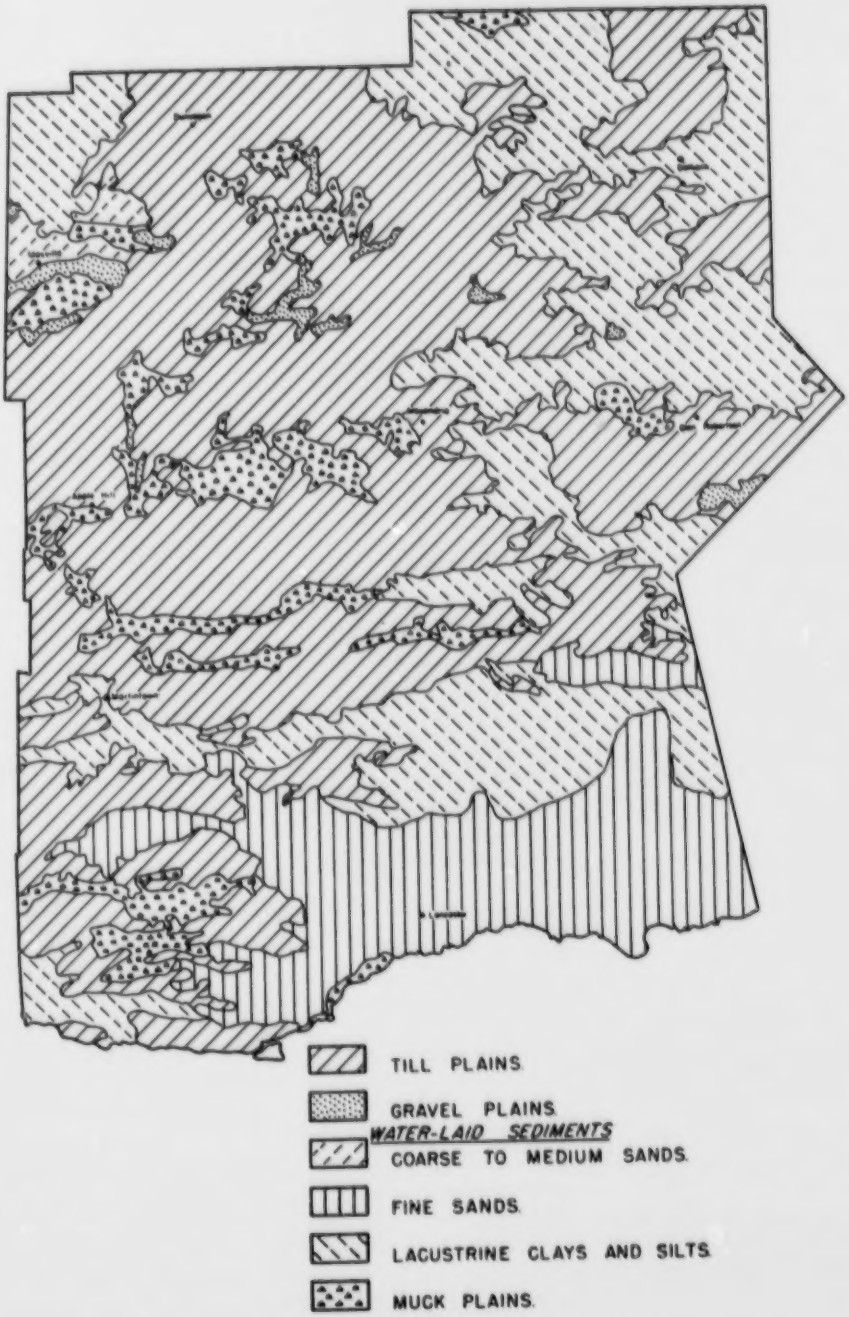


FIG. 2. Outline Map Showing Distribution of Soil Materials

In some instances, soil of a given type or series may possess physical features that limit its agricultural value; hence phases of a soil type or soil series are mapped. For example, a physical characteristic such as stoniness or topography may drastically change the agricultural value of a soil without altering the profile chracteristics sufficiently to place it in another soil type; hence phases of soil types have been mapped to delineate areas that have special problems for agricultural use.

SALIENT FACTORS AFFECTING USE AND PRODUCTIVITY OF SOILS IN GLENGARRY COUNTY

A soil survey provides a sound basis for a program of improved land use and soil conservation. All of the important factors of soil and climate are discussed later in the report. A brief resumé of these factors in relation to crop production is presented here as an introduction to the soils of Glengarry County.

Soil Parent Material

The effects of soil parent material on the type of soil developed are discussed in Part II. Parent material, i.e. the material from which the soil developed, is a fixed characteristic that the farmer cannot alter. Success in crop production depends on the ability of the farmer to adapt his cropping practices to make the best of the soils he has. In Table 1, the kinds of parent material and the important features of the soils are given.

TABLE 1

ACREAGES AND IMPORTANT FEATURES OF SOILS DEVELOPED FROM DIFFERENT PARENT MATERIALS

Parent Material	Acreage	% Total Acreage	Important Features of Soils
Glacial Till	127,400	42.0	Medium fertility; rich in lime; often stony; some erosion susceptibility.
Glacio-fluvial gravel	7,600	2.4	Coarse texture; medium to low fertility; stony; subject to erosion.
Outwash sands	12,000	3.9	Coarse texture; low to medium fertility; low moisture-holding capacity.
Lacustrine fine sands and silts	32,400	10.6	Medium to fine texture; difficult to drain; stonefree.
Lacustrine silts and clays	82,100	26.5	Fine texture; stonefree; high fertility; tendency to bake when dry; inadequate natural drainage.
Alluvial	19,400	6.4	Flood land along stream courses of variable texture and fertility; subject to seasonal flooding.
Organic	25,000	8.2	Partially decomposed plant remains; poorly drained; underlain by clay or sand.
Total	305,900	100.0	

More than forty per cent of Glengarry County is glacial till material that develops a medium textured soil well suited for general farming. The erosion hazard is not serious in view of the large acreage in hay and pasture for the dairy cattle.

Texture

There is a wide variation in texture of the surface soils of the County. The acreages in the different textural groups are shown in Table 2.

TABLE 2

APPROXIMATE ACREAGE OF SOILS OF DIFFERENT TEXTURAL CLASSES IN GLENGARRY COUNTY

Textural Classes	Acreage	% Total Acreage
Sand, sandy loam	13,600	4.7
Fine sandy loam	10,200	3.3
Loam	129,300	42.1
Silt loam, silty clay loam	42,600	13.9
Clay loam, clay	65,900	21.6
Total	261,600	

In general the soils of coarse texture, sands and sandy loams, contain fewer plant nutrients and are less capable of holding moisture than the finer textured soils. The medium textured soils (loams, and silt loams) in Glengarry County are fairly high in fertility and usually have fairly good drainage. Such soils are capable of producing a wide range of crops. The fine textured soils are generally level and inadequately drained. Tile drains and open ditches are required to bring these soils into satisfactory production.

Climate

The climate of Glengarry County is suitable for general farm crops. The temperature is usually too low during winter for the survival of winter wheat. Rainfall distribution, length of growing season, and average temperature during the growing season are satisfactory for many of the common farm crops.

Features that can be Modified

The three factors, parent material, texture, and climate mentioned above cannot be altered or controlled by the landowner or operator. There are, however, several factors affecting soil productivity that can be altered. A knowledge of the limiting features of the soil is essential before a planned program of good land use can be carried on. The following paragraphs describe the major alterable features of the soils that limit production and include recommendations for overcoming the limitations.

The knowledge of soil management in any given area has been accumulated over the generations often by the system of trial and error. Soil scientists are now seeking to learn which management practices are good and which new ones should be adopted. This section is concerned with the factors of the soil with no regard to factors foreign to the soil, such as disease, economics, and weather.

Drainage — Approximately 60% of the soils in Glengarry County have a drainage problem in some degree.

TABLE 3

ACREAGES OF DIFFERENT SOIL DRAINAGE CLASSES IN GLENGARRY COUNTY

Drainage Class	Acreage	% of Total
Well Drained	129,400	43.2
Imperfectly Drained	21,000	6.9
Poorly Drained	111,100	36.3
Very Poorly Drained	44,400	14.6
Total	305,900	100.0

About 15% of the County is very poorly drained and for much of this land reclamation for general farming is too costly at the present time. Most of the poorly drained soils are fine textured and high in fertility. The subsoil is often relatively impermeable.

Open ditches should be installed and existing ones should be kept clean. Where outlets are available, tile drainage will improve the growth of deep rooted legumes. In turn the legumes will improve those soils in which the impeded drainage is a result of an impervious subsoil. There is a need for investigational work to determine the most effective means of overcoming the drainage problem in Glengarry County to improve the reliability and versatility of the soils.

As shown in Table 3 more than 40% of the soils in the County are well drained. Wherever these soils are interspersed with imperfectly or poorly drained soils, the latter become of greater value in producing pasture and hay while the well drained soils produce the cereal grains and intertilled crops. A number of farms, however, particularly in Lancaster Township in the south-east part of the County have no well drained land; hence, artificial drainage becomes a necessity.

Stoniness and Erosion — The problem of excessive numbers of stones is a physical one that is especially important in the townships of Kenyon, Lochiel, and Charlottenburg. In many instances the soil is excellent for agriculture except for the stones and boulders. It is impossible to make a general statement as to the advisability of stone removal. The cost of removing the stones must be charged against the resultant increase in returns. Parts of the area have been cleared of stones and are producing good crops. Even if the stones are not removed, the land can be used for permanent pasture production.

Along with the stoniness problem, there is an erosion hazard in these Townships. Contour cultivation and strip cropping is advisable on some of the slopes.

Fertility — Although soils vary in their supplies of plant nutrients before cultivation, none of them will produce abundant crops for any extended period of time without supplemental fertilization. Cultivation also speeds up the decay of soil organic matter so constant additions of organic material as crop residues, green manure and farmyard manure are essential. Phosphorus is the plant nutrient most commonly deficient but in most instances complete fertilizers should be used. The most satisfactory basis for fertilizer recommendations is a soil test. Such tests can be obtained at the Kemptville Agricultural School.

Sub-marginal Cropland

Approximately 20 per cent of the land area of Glengarry County is sub-marginal cropland. The flood land along stream courses is generally devoted to permanent pasture and is especially valuable for this purpose during dry summer months.

The muck soils in the County have not been developed for agriculture. The distance to larger centres of population minimizes the value of the muck land for the production of truck crops.

FIG. 3. Outline Map Showing Major Land Use Hazards

PART I

GENERAL DESCRIPTION OF GLENGARRY COUNTY

Location and Area

Glengarry County is located in Eastern Ontario on the north shore of the St. Lawrence River. It is bounded on the west by Stormont County and on the north by the County of Prescott. The Province of Quebec borders the eastern side. The County is situated about equidistant from Ottawa and the city of Montreal, Quebec.

The total area of Glengarry County is approximately 478 square miles—(305,920 acres). According to the 1951 Census of Canada, 264,383 acres or about 90 per cent of the total area is occupied farm land. The remaining 10 per cent is taken up by towns and villages, road allowances, muck bogs, etc.

County Seat and Principal Towns

The city of Cornwall, in Stormont County, is the County seat for the United Counties of Dundas, Stormont, and Glengarry. Alexandria, with a population in

The lake and park at Alexandria is a popular recreation area.

1951 of 2,204 is the only incorporated town in Glengarry County. It is situated in the central part of the County at the junction of Highways 34 and 43. The office of the Agricultural Representative is located there. Alexandria is the educational and recreational centre for a large portion of Glengarry County.

Among the more important villages serving the rural population are Maxville (population 778); Lancaster (population 548); Glen Robertson, and Dalkeith. A

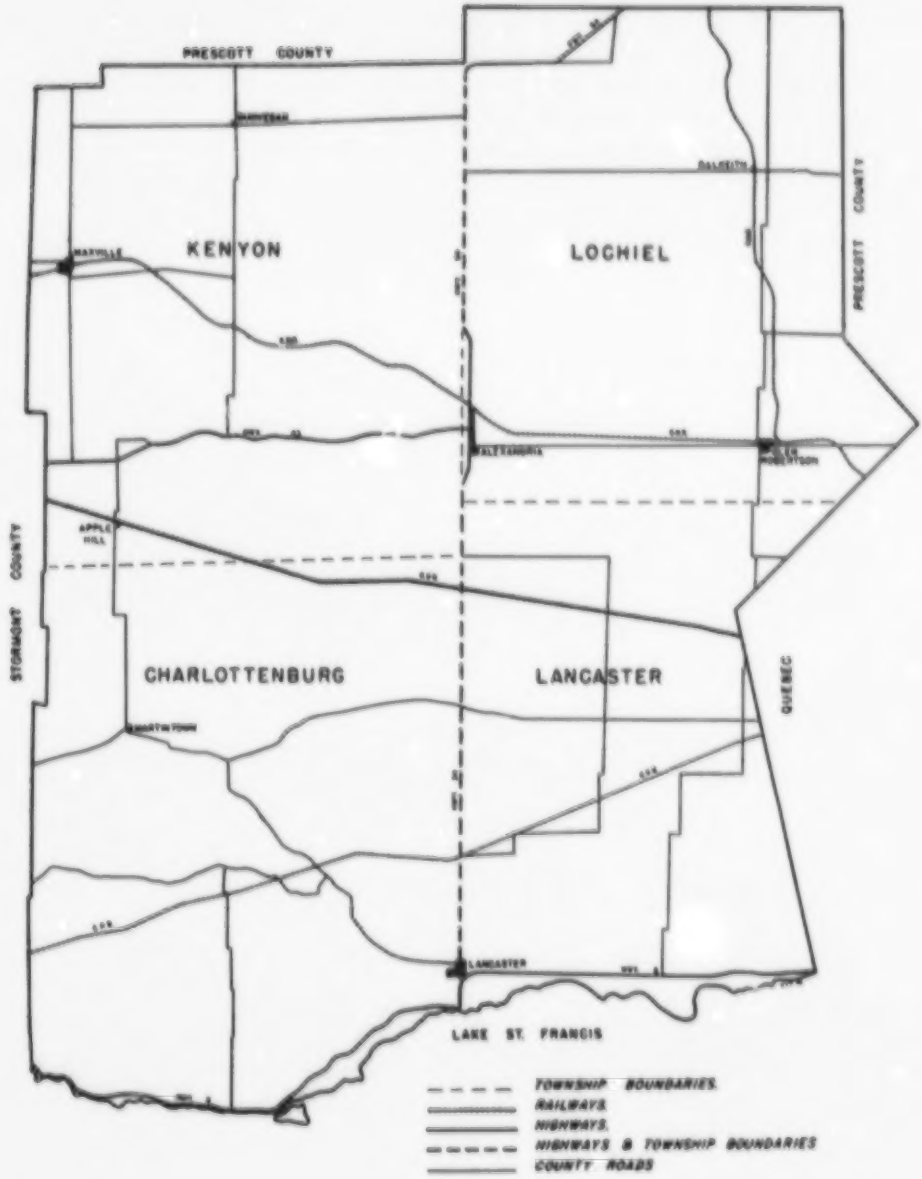


FIG. 4. Outline Map Showing Townships and Principal Centres

Dominion Government Illustration Station is situated near Williamstown in Charlottenburg township.

Glengarry County, typical of the cheese making areas of Eastern Ontario, has many small hamlets serving local communities. With a cheese factory and often a small general store and service station, centres like Laggan and Glenroy form an important part of the agricultural organization in the County.

Population and Racial Origin

According to the 1951 Census, the total population of Glengarry County was 17,702. Approximately 80 per cent, 15,498 people, were classified as rural dwellers. The remaining 20 per cent were classed as urban population and lived in the incorporated centres of Alexandria, Maxville, and Lancaster.

The figures in Table 4 indicate the trend of the population changes since 1851.

TABLE 4

POPULATION OF GLENGARRY COUNTY

Year	Rural Population	Urban Population	Total
1851			17,596
1861			21,187
1871			20,524
1881			22,221
1891			22,447
1901	18,888	3,243	22,131
1911	17,553	3,706	21,259
1921	16,926	3,592	20,518
1931	15,275	3,391	18,666
1941	15,069	3,663	18,732
1951	15,498	2,204	17,702

A marked decrease in the total population since 1901 is indicated by the above data. This decrease has occurred in the rural population. The minor fluctuations in the relatively small urban population did not contribute appreciably to the net change.

Most of the early history and development of Glengarry County can be attributed to the Scottish settlers. Modern statistics show, however, that a majority of the present residents of the County are of French descent. Classification according to racial origin is given below.

	1911	1941	1951
Total population	21,259	18,732	17,702
Canadians of British origin—Scottish	10,484	6,298	7,196
—Irish	977	985	
—English	815	936	
Canadians of French origin	8,710	10,121	10,055
Canadians of other origins	273	392	451

Transportation and Markets

Glengarry County is well supplied with roads and railways connecting the various parts of the County, and connecting the County with other parts of Ontario and Quebec.

Highway No. 2 passes through the front of the County along the St. Lawrence River, forming a link with Montreal and the Province of Quebec on the east and joining with the remainder of Southern Ontario to the west.

Highway No. 34 traverses the County from south to north. Running from Lancaster through Alexandria, this modern, well kept highway joins at Hawkesbury with Highway No. 17 to Ottawa and Montreal.

An alternate route to Ottawa is provided by Highway 43 from Alexandria west to Highway 31.

A network of County and township roads serves the needs of all parts of Glengarry County. However, many are not well surfaced due to the scarcity of suitable large gravel deposits.

The County has excellent rail connections with Quebec and the rest of Ontario. The main line of the C.N.R. from Toronto to Montreal, passes through Lancaster. The main line of the C.P.R. passes through Apple Hill and Green Valley in the central section of the County. Maxville, Greenfield, Alexandria, and Glen Robertson are served by the Ottawa to Montreal line of the C.N.R. A branch line of the C.N.R. runs north from Glen Robertson to Hawkesbury in Prescott County. Considerable fluid milk from Lancaster and Charlottenburg townships is carried by C.P.R.'s branch line from Montreal to Cornwall.

These rail and road connections supply adequate facilities for the marketing of the County's produce.

PART II

FACTORS AFFECTING THE FORMATION AND DEVELOPMENT OF THE SOILS OF GLENGARRY COUNTY

A knowledge of the soils of an area requires some knowledge of the factors that cause soil differences. The most important of these factors are: (1) soil parent material, i.e. the kinds of materials from which the soils have developed, (2) relief, i.e. the surface features of the land, the drainage conditions, etc., (3) climate which influences the kind and intensity of weathering and leaching of the soil material, (4) vegetation which affects the content of organic matter in the soil, (5) soil age, i.e. length of time weathering forces have been acting on the soil materials. In any given location, all of the factors are operative but usually one factor is dominant over the others. Thus the character of some soils is determined mainly by the character of the material from which they have developed, while in other soils, parent material is of minor influence and the properties of the soils are to a large extent governed by conditions of relief.

Soil Materials

This part of North America was subjected to at least three glaciations. However, only the surface deposits or those of the last (Wisconsin) glaciation influence the soils of Glengarry County.

The movement of the ice was generally in a north-south direction although in the southern part of the County the drumlins (elongated rounded ridges) roughly parallel the St. Lawrence River valley, indicating that the ice advanced locally from the north-easterly direction. Following the recession of the ice, an arm of the sea, named Gilbert Gulf, entered this area. During this period many of the fine particles were washed from the ridges leaving the boulders. As the ice retreated farther the land commenced to rise and eventually came above sea-level.

Most of Glengarry County is underlain by limestone of the Trenton and Black River formations. Some Beekmantown dolomite occurs in the north-eastern part of Lochiel Township. Along the St. Lawrence River and inland in Lancaster Township, the underlying bedrock is chazy limestone. The Trenton limestone is readily broken up and, therefore, is generally covered with a good depth of till. There is very little rock outcrop in the County.

A more complete discussion of the bedrock formations of the area has been written by Chapman and Putnam.*

Although the soil materials have been transported, they do bear some relation to the surface rock formation. The Trenton limestone is dominantly calcium carbonate but has a rather high percentage of insoluble matter.

The dominant chemical characteristics of the underlying bedrock is reflected in the soils which have a high content of calcium carbonate.

Another factor that affects the soil parent materials is the mode of deposition. Materials of two general groups occur in Glengarry County: (1) unsorted tills laid

*Chapman, L. J. & Putnam, D. F., The Physiography of Eastern Ontario, Sci. Agr. 20:7, 1940.

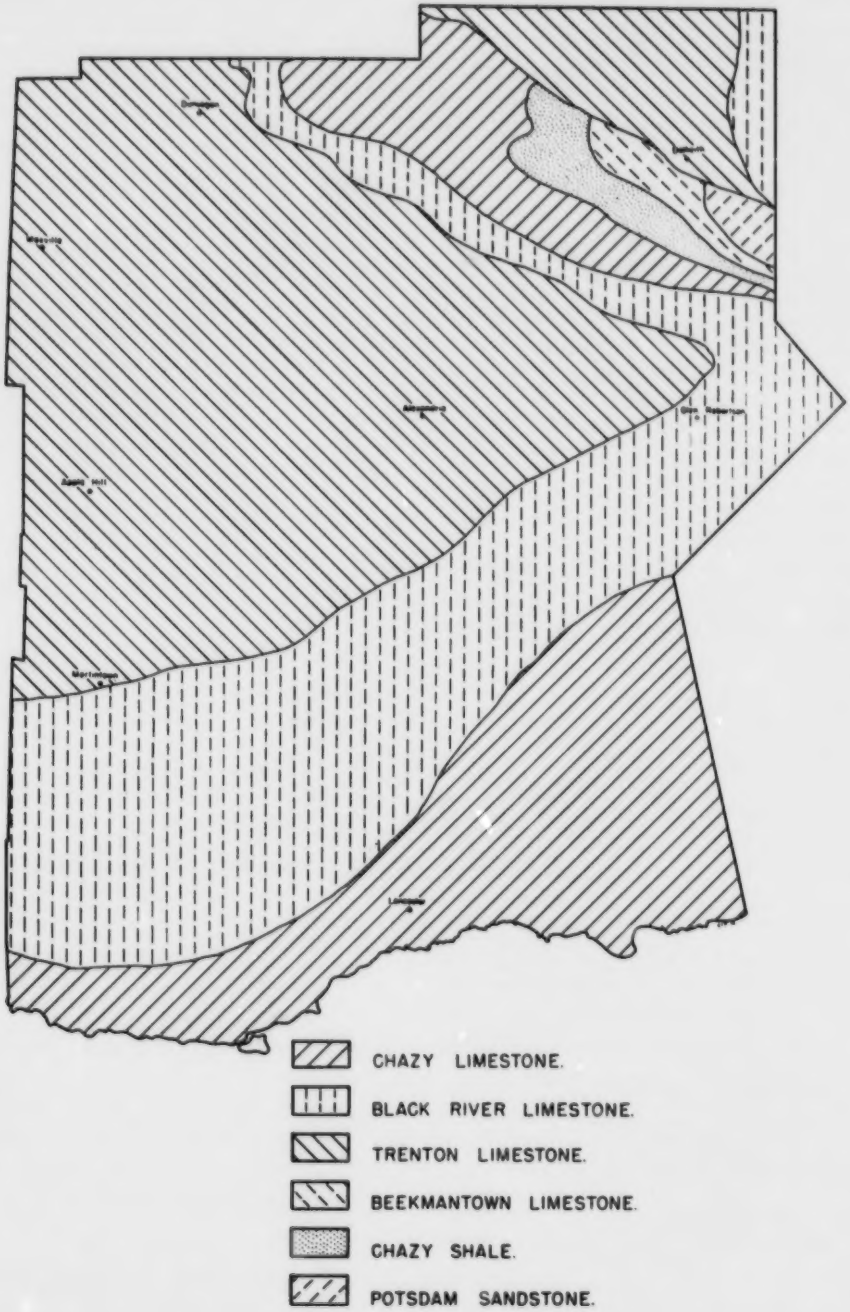


FIG. 5. Outline Map Showing Bedrock Geology

down by ice, (2) sorted clays, silts, sands and gravels deposited by water. The tills are further differentiated on the basis of size and kind of stones and the kind of fine material between them. The water-laid materials are grouped according to the size of the particles.

After the ice sheet disappeared from the area a deposit of till of varying depth remained over the Trenton limestone bedrock. Much of the till was left arranged in the form of long oval shaped hills (drumlins) whose long axes are roughly parallel to the direction of movement of the glacier. Soils developed on till are generally good agricultural soils characterized by rolling topography, with some stones throughout the profile.

A large portion of the area consists of water-laid material, an indirect result of glaciation. During the recession of the ice, meltwaters rushed in streams through crevasses in the ice and deposited coarse gravel and sand that remain today as long narrow ridges called "eskers". These ridges provide a good source of road gravel.

Extensive areas of medium sand materials also occur. Such material was deposited by moving water as it slowed down and flowed out over the area in front of the glacier. The topography is usually level to slightly undulating. As the ice receded and the waters of Gilbert Gulf and Champlain Sea covered the area much sediment was formed in the depths of these post-glacial waters. The sediment is fine textured, and stonefree. It is less alkaline than the till and generally is inadequately drained, partly because of its level topography.

Till Deposits

The till deposits are made up of stones, dominantly limestone with some sandstone and Precambrian rocks ranging in size from very fine grit to large boulders scattered throughout a matrix of sand, silt and clay in varying proportions. The till area is generally smooth gently sloping but in the southern part of the County the topography is moderately to steeply sloping. In Kenyon and Lochiel Townships the till is calcareous and stony and contains some sandstone fragments. Numerous Precambrian rocks are scattered over the surface. In the southern part of the County, however, the till is more highly calcareous and contains less sandstone.

Gravelly Deposits

Long narrow ridges of gravelly material occur throughout the County particularly in association with the till materials. This material was deposited in the beds of glacial streams and it ranges from fine sand to large boulders.

Deposits of Water-laid Sediments

Water-laid sediments range in texture from sand to clay and are typically stonefree.

(a) *Coarse textured material*

There is only a limited area of sand plains in Glengarry County and these are in association with the gravel ridges. The topography is level to undulating.

Sand deposits occur near Maxville and St. Elms. Along the banks of the Raisin River acidic fine sands occur in small areas. All of the sand plains are underlain by clay usually within ten feet or less of the surface. Hence, around the periphery of the sand areas there is often an area of shallow sand over clay.

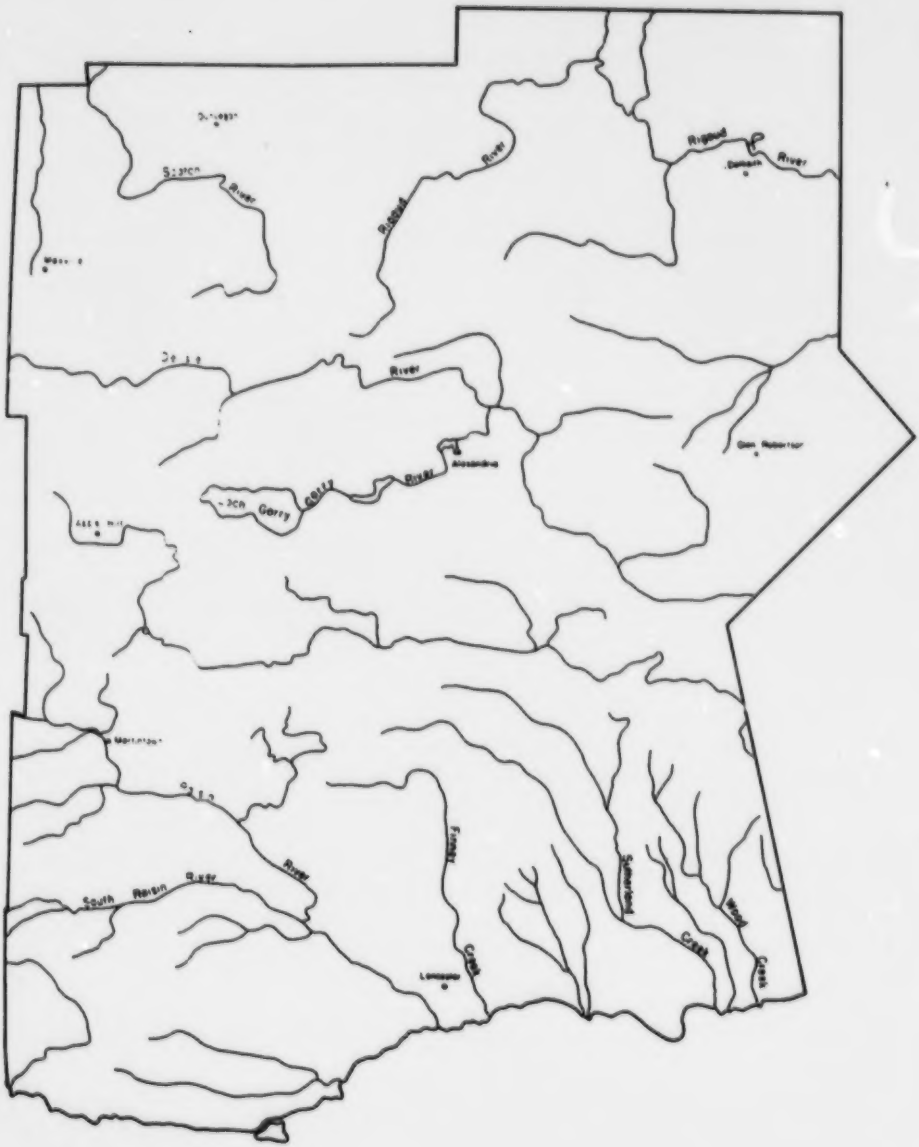


FIG. 6. Outline Map Showing Drainage Systems

(b) *Medium textured materials*

Along the St. Lawrence River from Summerstown to the Quebec border and extending inland for four to six miles, there is a fairly continuous area of stratified fine sand and silt underlain by clay. These stonefree materials were deposited as sediments in the Champlain Sea during the later stages of its existence or as alluvium of the St. Lawrence River. The topography is level.

(c) *Fine textured materials*

Water-laid clays and silts deposited in the Champlain Sea occupy 29.6% of Glengarry County. The clays in the northern part of the County are irregularly stratified brown and grey and contain less lime than the grey clays in the southern part. The uniform grey clays occur in Charlottenburg township and in extensive areas in Lancaster Township. The topography is level. Drainage improvement is necessary for maximum crop production.

Muck Deposits

The surface layer of the muck deposits is largely of organic origin, the material being in various stages of decomposition. In most instances, the muck is underlain by clay although grey sand or loam till may be found in some areas.

Relief

Glengarry County is characterized as a region of modest relief. The maximum elevation is slightly over 375 feet above sea level, and occurs just south of Maxville at the western edge of the County. The height of land runs roughly parallel to the St. Lawrence River and has an elevation at Brodie, near the eastern boundary, of about 275 feet above sea level. The elevation along the banks of the St. Lawrence to the south is about 150 feet above sea level.

Two distinct kinds of topography occur in the County. The till plains which cross the County diagonally from south-west to north-east exhibit an undulating to gently rolling relief with occasional steeper slopes on the drumlins in Charlottenburg township. In contrast to this, the clay plains to the east and the fine sand and silt plains to the south present a level to very gently sloping landscape, broken only by a few till ridges protruding above the water-laid sediments.

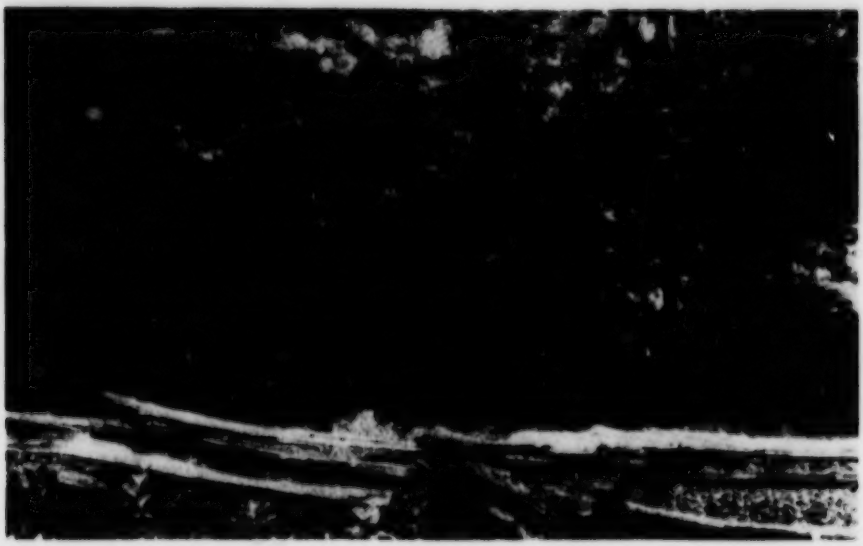
The low relief has a marked influence on the drainage pattern of the County and on the extent of soil erosion losses.

To the north of the drainage divide, the Scotch River and tributaries of the Caledonia Creek drain by way of the Nation River to the Ottawa River. The Rigaud River and its branches, which empties into the Ottawa River beyond the Quebec border is the drainage channel for part of Kenyon and the northern half of Lochiel townships. To the south of the divide the drainage is to the St. Lawrence River by way of the Raisin, Delisle and Beaudette Rivers and a number of other smaller streams. Many of these drainage ways have little fall and flow sluggishly through most of the year.

Climate

Glengarry County is in the Eastern Ontario climatic region of Southern Ontario as classified by Putnam and Chapman*. The mean annual temperature is 42° F as

*Putnam, D. F. and L. J. Chapman, The Climate of Southern Ontario, Sci. Agr. 18:8, April, 1938.



Sugar Maple and Beech predominate on well drained soils in Glengarry County.

Elm is the common tree cover on poorly drained soils in Glengarry County.

compared with 44° at Guelph, 45.3° at Brantford and 32° at Kapuskasing. The extreme low temperature recorded for the area is —44° F while the extreme high is 104° F. The average date of the last frost in the spring is between May 11-24 with 130 to 140 days in the frost-free period. The average length of the growing season is 191 to 197 days.

The precipitation varies from 34-40 inches annually. About 17-18 inches of rain fall on the average during June, July and August, an amount that is adequate for most farm crops. Drought frequency is low.

Natural Vegetation

During the time that it is becoming established, vegetation is dependent on climate and soil conditions. However, when it is established, vegetation exerts a strong influence on the type of soil developed. The types of litter found under coniferous and decidous forests are quite different in chemical composition, consistency, and ease of decomposition.

It is impossible to determine which features of the soils of Glengarry County have been influenced by vegetation only, because all the other soil forming factors have been operating simultaneously. Indeed, it is difficult to determine the native vegetation on certain soil types because only about eight per cent of the area is wooded under present land use. Certain associations of trees, however, have been observed to occur on certain soil areas more often than others.

The upper St. Lawrence Section of the Great Lakes-St. Lawrence Forest Region as described by Halliday includes the County of Glengarry.

The general character of the tree cover is broad leaved but there is a fair representation of coniferous growth. The dominant association on well drained sites is sugar maple and beech with small numbers of birch, ash, and elm. Hemlock, white spruce and pine occur on the light soils. In poorly drained areas elm dominates along with tamarack, white cedar and black ash. Clumps of cedar are characteristic of stony sites.

Time

The influence of time as a soil forming factor is well expressed in the soils of Glengarry County. The soils of this County, like those of all Eastern Ontario, are young in comparison with the soils of the remainder of Southern Ontario. At the time of the last, or Wisconsin glaciation, the weight of the ice mass compressed the earth's crust so that much of Ontario was below the level of the sea. As the recession of the glacier came about the glacial drift was exposed and the processes of soil formation began to act. However, the ice left Eastern Ontario late in the recession, and this low lying land then was inundated for considerable time by the post-glacial Champlain Sea. It has been estimated that the soil materials of this area have been exposed for from 4,000 to 8,000 years. In comparison, most of Western Ontario has been free of ice and inundation for at least 15,000 years.

A youthful soil is characterized by an immature profile with a relatively shallow solum. These characteristics are typical of Glengarry County soils. Undifferentiated soil materials are commonly found at depths of fifteen to thirty inches, depending upon their nature and physiographic position. Some of the well drained coarse sands are weathered to a depth of three feet or greater. The relative youth of the soils, along with the calcareous nature of the parent materials, is largely responsible for the predominance of the Brown Forest soils in the County.

PART III

CLASSIFICATION AND DESCRIPTION OF GLENGARRY COUNTY SOILS

Although knowledge of the factors that have affected the development of the soils of Glengarry County is interesting, it is of little help in planning the efficient use of the soils as they exist today. It is the purpose of this part of the report to present a detailed description of each soil type with regard to its profile features as well as other features of significance to the agricultural use of the soil.

Summary of the Classification of the Soils of Glengarry County

	Acreage	% of Total
A. Soils Developed from Till		
(1) Brown Forest soils		
(a) Well drained		
(1) Eamer Series		
(a) Eamer loam (El)	48,300	15.8
(b) Eamer loam-bouldery phase (El-b)	3,400	1.1
(2) Grenville Series		
(a) Grenville loam (Gl)	65,800	21.5
(b) Grenville loam-shallow phase (Gl-s)	4,200	1.4
(b) Imperfectly drained		
(1) Matilda series		
(a) Matilda loam (Ml)	5,800	1.9
(2) Dark Grey Gleisolic soils		
(a) Poorly drained		
(1) Lyons Series		
(a) Lyons loam (Ll)	1,800	.6
B. Soils Developed from Roughly Stratified Sand and Gravel		
(1) Grey-Brown Podzolic soils		
(a) Well drained		
(1) Kars Series		
(a) Kars gravelly sandy loam (Kal)	7,600	2.5
C. Soils Developed from Sorted Outwash Materials		
(1) Medium Sand		
(a) Podzol soils		
(1) Well drained		
(a) Uplands Series		
(i) Uplands sandy loam (Usl)	200	.1
(2) Imperfectly drained		
(a) Rubicon Series		
(i) Rubicon sandy loam (Rsl)	3,000	1.0
(b) Dark Grey Gleisolic soils		
(1) Poorly drained		
(a) Granby Series		
(i) Granby sandy loam (Gsl)	1,300	.4

	Average	% of Total
(2) Fine sand		
(a) Podzol soils		
(1) Well drained		
(a) St. Thomas Series		
(i) St. Thomas fine sandy loam (Tfsl)	100	.1
(2) Imperfectly drained		
(a) L'Achigan Series		
(i) L'Achigan fine sandy loam (Afsl)	3,100	1.0
D. Soils Developed from Sorted Outwash Underlain by Lacustrine Material		
(1) Soils formed from sand underlain by clay low in lime		
(a) Dark Grey Gleisolic soils		
(1) Poorly drained		
(a) Allendale Series		
(i) Allendale sandy loam (Asl)	1,500	.5
E. Soils Developed from Deltaic Fine Sands and Silts		
(1) Ground-water Podzol soils		
(a) Imperfectly drained		
(1) Castor Series		
(a) Castor very fine sandy loam (Cvfsl)	6,600	2.1
(b) Castor very fine sandy loam-shallow phase (Cvfsl-s)	400	.1
(c) Castor silt loam (Csil)	300	.1
(2) Dark Grey Gleisolic great soil group		
(a) Poorly drained		
(1) Bainsville silt loam (Bsil)	19,200	6.3
F. Soils Developed from Deltaic Fine Sands and Silts Underlain by Lacustrine Clay within three feet		
(1) Dark Grey Gleisolic soils		
(a) Poorly drained		
(1) Marionville Series		
(a) Marionville silt loam (Msil)	6,900	2.2
G. Soils Developed from Lacustrine Materials		
(1) Silt loam		
(a) Dark Grey Gleisolic soils		
(1) Poorly drained		
(a) Osgoode Series		
(i) Osgoode silt loam (Osil)	14,700	4.8
(ii) Osgoode silty clay loam (Osicl)	1,500	.5
(2) Grey clay, slightly calcareous		
(a) Dark Grey Gleisolic soils		
(1) Poorly drained		
(a) North Gower Series		
(i) North Gower clay loam (NGcl)	13,400	4.4
(ii) North Gower clay (NGc)	7,600	2.5
(3) Stratified Brown and Grey Clay		
(a) Grey-Brown Podzolic soils		
(1) Imperfectly drained		
(a) Wendover Series		
(i) Wendover clay (Wc)	1,800	.6
(b) Dark Grey Gleisolic soils		
(1) Poorly drained		
(a) Bearbrook Series		
(i) Bearbrook clay (Bc)	41,400	13.5

	Average	% of Total
(4) Grey clay, non-calcareous		
(a) Dark Grey Gleisolic soils		
(1) Poorly drained		
(a) Ste. Rosalie Series		
(i) Ste. Rosalie clay (Rc)	1,700	.5
H. Soils Developed from Organic Material		
(1) Shallow underlain by clay		
(a) Organic great soil group		
(1) Very poorly drained		
(a) Belmeade Series		
(i) Belmeade muck (Bm)	2,400	.8
(2) Deep Organic Deposits		
(a) Organic great soil group		
(1) Very poorly drained		
(a) Muck (M)	22,600	7.4
I. Soils Developed from Recent Alluvium		
(1) Flood land along stream courses		
(a) Alluvial great soil group		
(1) Bottom Land (B.L.)	19,400	6.3

Those who need to become familiar with all of the soil types in the County will find it helpful to understand the relations between the different soil types. Table 5 will help to make these relations clear. Soil types that appear in the same vertical column and between two horizontal double lines generally present similar problems in land use.

DESCRIPTION OF GLENGARRY COUNTY SOILS

A. Soils Developed on Till

The loam textured till materials found in Glengarry County may be divided into two groups on the basis of the carbonate content. The moderately calcareous till was derived from Black River limestone predominantly, while the highly calcareous till is underlain by Trenton limestone.

The Grenville catena includes the medium textured soils developed on those sections of the till plain underlain by Black River formation. The Grenville catena consists of the well drained Grenville series, the imperfectly drained Matilda series and the poorly drained Lyons series. The well drained soils developed on Trenton limestone materials are classified as the Eamer series. The imperfectly and poorly drained associates of the Eamer series have not been separated from the corresponding members of the Grenville catena.

Grenville Series (30,000 acres)

The Grenville series is developed from morainic material that, in Glengarry County, is underlain predominantly by limestone of the Black River formation. The topography on which the series developed is undulating to slightly rolling. On the gentler slopes, areas of imperfect drainage having soil similar to Matilda loam may

TABLE 5

GLENGARRY COUNTY SOILS GROUPED ACCORDING TO TEXTURE PARENT MATERIAL AND DRAINAGE*

Texture of Surface Soil	Parent Material	Well Drained	Imperfectly Drained	Poorly Drained
Coarse	gravel, medium lime	Kars gravelly sandy loam		
	medium sand, low lime	Uplands sandy loam	Rubicon sandy loam	Granby sandy loam
	medium sand over clay			Allendale sandy loam
	fine sand, low lime	St. Thomas fine sandy loam	L'Achigan fine sandy loam	
Medium	glacial till, high lime	Grenville loam	Matilda loam	Lyons loam
		Grenville loam-shallow ph.		
	glacial till, very high lime	Eamer loam		
		Eamer loam-bouldery phase		
Medium to fine	very fine sand and silt		Castor very fine sandy loam	Bainsville silt loam
			Castor very fine sandy loam-shallow phase	
			Castor silt loam	
	silt			Osgoode silt loam
				Osgoode silty clay loam
Fine	silt underlain by clay			Marionville silt loam
	grey clay			North Gower clay loam
				North Gower clay
	grey clay, low lime			Ste. Rosalie clay
	stratified brown and grey clay		Wendover clay	Bearbrook clay
Organic	Shallow organic over clay			Belmeade
	Deep organic			Muck

*Bottom Land soils are not included in the table. Differences among Bottom Land soils are presumably due to differences in parent materials.

occur as a result of seepage from adjacent areas of higher elevation. The Grenville series belongs to the Brown Forest Great Soil Group.

Grenville loam (65,800 acres).

Grenville loam-bouldery phase (4,200 acres)

The following is a description of the Grenville loam as commonly found in uncultivated woodlots in Glengarry County:

A_0 — ½–0 inch of matted leaves and twigs

A_1 — 0–4 inches of very dark grey-brown (10YR 3/2)* loam; friable; medium crumb structure; medium in organic matter; few stones; no free carbonates; pH — 7.0

B_1 — 4–7 inches of pale brown (10YR 6/3) loam; friable weak small nuciform structure; very indistinct horizon; pH — 6.8

B_2 — 7–16 inches of dark grey-brown (10YR 4/2) loam; friable; medium nuciform structure; few stones; no free carbonates; pH — 7.0

C_1 — 16–26 inches of dark grey-brown (10YR 4/2) loam; stony; free carbonates; not compacted; pH — 7.6

C_2 — Grey (10YR 5/1) or grey-brown (10YR 5/2) loamy till; stony; slightly compacted; calcareous; pH — 7.8

The parent material consists of unsorted till dominated by limestone with some sandstone fragments.

Stones occur throughout the profile and, in some areas, boulders occur on the surface in sufficient numbers to interfere with cultivation. Such areas are mapped as the bouldery phase of the Grenville loam.

In Lochiel township and in adjoining areas of Kenyon and Lancaster townships, there are areas mapped as Grenville loam in which the soil is lower in lime, has some sandy or clayey overwash and a less well defined structural B horizon than the normal Grenville type.

When cultivated, the surface soil becomes a grey-brown loam of medium organic matter content. The natural vegetation includes sugar maple, beech, ash, and some elm.

Agriculture

Most of the Grenville loam is now cleared and used for agricultural purposes. General farming and dairying are carried on to advantage as, corn, alfalfa, clover, and small grains thrive on this soil type.

The supply of plant nutrients and lime is medium. The type of agriculture that stresses dairying provides a good supply of barnyard manure for return to the soil. For the production of clovers and alfalfa, applications of potash and phosphorus prove profitable; nitrogen should also be added for cereals and corn.

*Colour code number as taken from Munsell Colour Chart.

The fertility of the Grenville loam is fairly high but stoniness often hinders cultivation. If the boulders are not too numerous, it may be economical to remove them but, in many instances, the very stony land is used for pasture production.

The shallow phase of the Grenville loam occurring in Kenyon township is similar in fertility to the normal type. However, the bedrock occurring within two feet of the surface inhibits plant root development and reduces the moisture-holding capacity of the soil.

In a few areas where drumlins are common, erosion may be a problem especially if row crops are grown. Normal good management practices, however, usually suffice to control erosion on the Grenville soil type.

Eamer Series (151,700 acres)

Another group of soils developed on loamy till in Glengarry County is the Eamer series. The soils of this series are well drained and are developed on till that, being derived from Trenton limestone, is higher in lime than the till of the Grenville series. The topography is strongly undulating to rolling resulting in greater susceptibility to erosion than on the latter series.

Eamer loam (48,300 acres).

Eamer loam-bouldery phase (3,400 acres)

The profile characteristics of the Eamer series are those of the Brown Forest Great Soil Group. A description of a virgin profile of Eamer loam is presented below:

A_0 — ½–0 inch of matted leaf litter

A_1 — 0–5 inches of very dark grey (10YR 3/1) loam; friable; medium crumb structure; medium to high in organic matter; few stones; free carbonates may be present; pH — 7.0

B_1 — 5–10 inches of dark grey-brown (10YR 4/2) loam; friable; fine nuciform structure; few stones; free carbonates; pH — 7.0

B_2 — 10–18 inches of very dark grey-brown (10YR 3/2) loam; friable; medium nuciform structure; stones and boulders; free carbonates; pH — 7.2

C_1 — 18–23 inches of grey-brown (10YR 5/2) loam; slightly compacted; very weak fine nuciform structure; stony; calcareous; pH — 7.6

C_2 — Grey (10YR 5/1) loamy calcareous till; stony; somewhat compacted; pH — 8.0

The parent material is characteristically stony but in some areas where eskeroid deposits are present it becomes excessively stony. The parent material has some tendency to be compacted but no hardpan layer is developed in this soil.

A number of boulders, chiefly limestone, with some granite erratics are scattered about the surface, often in sufficient numbers to hinder normal cultivation.

The natural vegetation includes sugar maple, elm, and basswood.
The internal and external drainage is good.

When cultivated, the surface soil consists of a dark grey-brown loam of medium organic matter content.

Bouldery phase of Grenville loam or Eamer loam is non-cropland.

Agriculture

The Eamer loam is well adapted to general farm crops provided that the boulders are not too numerous. It is well supplied with lime and is fairly well supplied with other available plant nutrients. Cereals, hay, especially alfalfa and clovers, and pasture thrive on this soil. Addition of phosphatic fertilizers may give profitable increases in yield.

Because the topography is strongly undulating to rolling, there are many slopes on which erosion is a problem. On certain slopes, it may be advisable to break up the sod only about once in five years to renew the hay and pasture.

Eamer Loam, Bouldery Phase (3,400 acres)

Where stones and boulders occur on the surface of the ridges in numbers great enough to prohibit cultivation the soil has been mapped as the bouldery phase. Such areas commonly remain as woodland or are cleared and used as unimproved permanent pasture. Fair to good crops of forage grasses can be grown. This is probably the most satisfactory use for this bouldery land.

Matilda Series (4,600 acres)

The Matilda series is the imperfectly drained member of both the Grenville and the Eamer catenas. It was not possible to differentiate between the inadequately drained members of the two catenas. Matilda loam, the only type in the series, is an imperfectly drained Brown Forest Soil. The profile horizons are less distinct than in the well drained soils due chiefly to the imperfect drainage. The type occurs on undulating topography and on the lower slopes of drumlins.

The following is a description of a Matilda loam profile under cultivation:

A_C — 0–8 inches of greyish brown (10YR 5/2) loam; friable; medium crumb structure; few stones; medium organic matter content; no free carbonates; pH — 7.0

B_1 — 8–15 inches of brown (10YR 5/3) loam; slightly mottled; friable; fine crumb structure; pH — 6.8

B_2 — 15–22 inches of brown (10YR 5/3) loam; mottled; friable; weak nuciform structure; horizon is relatively indistinct and not always present; pH — 7.0

C — Grey (10YR 6/1) loamy calcareous till; stony; free carbonates; pH — 7.4

The parent material varies in pH from 7.2 to 8.0. It tends to become compacted and to hinder the natural internal drainage. The relatively smooth relief contributes to inadequate external drainage.

In some areas, considerable water washing has mixed some lacustrine material with the till materials. Such profiles are irregular in occurrence in areas that are too small to delineate. Matilda loam commonly occurs in seepage areas often too small to show on map within larger areas of Grenville loam.

The natural vegetation consists of elm with some maple on the better drained sites.

When cultivated, the surface soil is a grey-brown loam of medium organic matter content.

Agriculture

In general, the Matilda loam is used for semi-permanent pasture and hay production. It is fairly well supplied with nutrients and lime. Where local drainage conditions are improved, it compares favourably with the Grenville loam as an agricultural soil.

Artificial drainage is of value in this soil provided that the number of stones does not make tile drainage impractical. Buckwheat is well adapted to this type and, with favourable weather at seeding time, some spring grains can be grown even without improved drainage.

Lyons Series (1,300 acres)

The Lyons series, which is the poorly drained member of the Grenville and Eamer catenas, is represented in Glengarry County by the Lyons loam. It belongs to the Dark Grey Gleisolic great soil group as evidenced by the profile description below:

(With the exception of the A_e, the profile horizons are poorly defined.)

A_e — 0–10 inches of very dark brown (10YR 2/2) stony loam; high in organic matter; sometimes free carbonates are present; pH — 7.2

G — 10–24 inches of mottled grey (10YR 5/1) stony loam that grades into the parent material; pH — 7.5

C — Grey calcareous stony till; pH — 7.8

The entire profile is usually stony and hence artificial drainage is often impractical. The topography is depressional; hence there is often considerable seepage from adjoining uplands. As the amount of organic matter in the surface layer increases, the type grades into areas of muck.

Most of the soil of this type is supporting its natural vegetation of cedar, poplar, and elm, or has been cleared for permanent pasture.

Agriculture

The surface soil is fairly well supplied with plant nutrients but the poor drainage limits the type chiefly to the production of permanent pasture.

B. Soils Developed on Roughly Stratified Sand and Gravel (Glacial-fluvial Materials)

As the last great ice sheet melted, streams of meltwater made their way through great crevasses in the ice and finally flowed out in front of the glacier. Rock debris which was originally held by the ice was carried by the streams, and was deposited in their beds. When the ice finally melted from the area, the beds of the glacial streams remained as long narrow ridges of coarse sand and gravelly material. As a result of the above mode of deposition the relief is hilly, a condition that does not readily lend itself to general farming practices.

Kars Series (7,600 acres)

All of the glacial-fluvial material in Glengarry County is classified in the Kars series. This series is well drained. The other catenary members were not encountered in areas large enough to delineate on the map of Glengarry County.

The Kars series is represented by one soil type, the Kars gravelly sandy loam. The usual topographic form is one of long narrow ridges whose axes are roughly parallel to the direction of ice movement. The profile is well drained and, in some instances, excessively drained.

The profile characteristics identify the Kars with the Grey-Brown Podzolic great soil group.

A_0 — ½–0 inch layer of leaf litter

A_1 — 0–4 inches of dark grey-brown (10YR 4/2) sandy loam; very friable; very fine crumb to single grain structure; few stones; pH — 6.8

A_2 — 4–12 inches of yellow-brown (10YR 5/6) sandy loam; very friable; single grain structure; few stones; pH — 6.6

B — 12–17 inches of dark brown (10YR 4/3) gravelly loam or sandy loam; friable; small nuciform structure; few stones; pH — 7.0

C — Roughly sorted gravel and sand; some free carbonates; some boulders; pH — 7.0, contains some shale fragments.

Wherever the drainage is excessive, the horizon development is less distinct. The natural vegetation is maple with some beech and pine. Elm may occur in slight depressions.

There were many small cobble stones scattered about the surface, under natural conditions, but most of these have been removed from cultivated land and placed in stone piles. The cultivated surface soil is a light grey-brown sandy loam, low in organic matter. It is also low in essential plant nutrients; hence fertilization is necessary if the soil is used for general farm crops.

Agriculture

The stones that occur in the upper horizons of the Kars gravelly sandy loam may hinder the use of farm machinery. The removal of the stones from the surface increases the cost of bringing the soil into production and as the inherent productivity of the soil is low, stone removal may not be economical.

For specialized early crops such as potatoes and small fruits, the type is well suited provided that commercial fertilizer is used.

The rolling topography is conducive to erosion. Hence, during cultivation, the control of erosion is a problem. In addition, the coarse open subsoil tends to cause the soil to be droughty although the B horizon, which is relatively heavy in texture, aids in retaining a favourable moisture relationship.

During wet seasons, the Kars gravelly sandy loam becomes one of the better soils in the County for general farm crops because of its good drainage.

An area of Kars soil near Maxville is somewhat finer in texture than the normal Kars type. These loamy gravelly soils are less droughty, gently sloping and fairly high in fertility. The soils in this limited area rank among the better agricultural soils in the County.

C. Soils Developed from Sorted Outwash Materials

(1) Medium Sand.

The parent materials of this group of soils were deposited by water as it flowed out over the area in front of the glacier. As the rate of flow of the water decreased, particles of sand and fine gravel settled out to form the outwash plains of today. The topography is undulating with some gullying along stream courses. There is only a small acreage of water-laid sand in Glengarry County.

The medium sandy deposits of three feet or more in depth are classified in the Uplands catena which includes the well drained Uplands series, the imperfectly drained Rubicon series, and the poorly drained Granby series.

Uplands Series (100 acres)

The Uplands soils have developed on strongly undulating to rolling outwash sand or sandy loam under good to excessive drainage conditions. The open nature of the subsoil and the low lime content of the parent material favour the development of a Podzol type of profile as described below:

A_e — 0–3 inches of very dark grey (10YR 3/1) sandy loam; friable; single grain structure; medium to low in organic matter; pH — 6.0

Uplands sand is low in plant nutrients and tends to be droughty. Note the grey A_2 horizon characteristic of podzol soils.

A_2 — 3–5 inches of grey (10YR 5/1) sand; very friable; single grain structure; pH — 5.8

B — 5–17 inches of brown (10YR 5/3) sandy loam; friable; single grain to weak crumb structure; pH — 6.4

C_1 — 17–24 inches of yellow-brown (10YR 5/6) sand; friable; single grain structure; pH — 6.4

C_2 — Grey (10YR 5/1) sand and gravel; non-calcareous; pH — 6.6

There are no boulders within the profile, although a very occasional one may be found on the surface. If the soil is unprotected, "blow out" spots tend to develop. Coniferous forest is the common natural vegetation. The cultivated surface soil is very low in organic matter. Chemical tests indicate that the available plant nutrients also are in short supply.

Agriculture

A large proportion of the Uplands soil has been cleared and cultivated but has now been returned to pasture. The soil is not well suited to general farming because of low fertility and a tendency to be droughty. With adequate fertilization, grain and potatoes can be grown during seasons of favourable moisture supply.

Rubicon Series (3,000 acres)

The Rubicon soils contain the imperfectly drained members of the Uplands catena. They are found in undulating topography with numerous small knolls and depressions, hence the drainage conditions vary within short distances from good on the knolls to poor in the depressions.

The imperfectly drained soils which generally represent the larger proportion of areas of Rubicon soils are ground-water podzols, while on the better drained knolls the Upland Podzol is dominant and the poorly drained depressions are generally occupied by the Granby series.

A description of an average imperfectly drained Rubicon soil is given below:

A_e — 0–5 inches of dark grey (10YR 4/1) sandy loam; very friable; single grain structure; pH — 6.5

A_2 — 5–10 inches of ashy grey (10YR 7/1) sand; very friable; single grain structure; pH — 6.0

B — 10–20 inches of dark brown (10YR 4/3) sandy loam; somewhat cemented; compact; pH — 6.2; grades into mottled brown sand. (Small pockets of ortstein may occur in this horizon).

C — Grey (10YR 5/1) sand sometimes stratified with silt or gravel; pH — 6.8

D — Underlain by clay at depth of 3 feet or more.

There are practically no stones throughout the profile nor on the surface. The native vegetation is predominantly elm, pine, and soft maple.

Under cultivation, the surface soil is yellow-brown on the knolls and dark grey in the depressions with streaks of ashy grey scattered throughout wherever the plow reaches the A_2 horizon. The soil in the depressions is often closely similar to the Granby as described later. The soil is moderately acid and low in plant nutrients.

Agriculture

The utility of this soil type is quite variable depending on the area of well drained knolls in proportion to the area of inadequately drained depressions. The open nature of the soil materials renders the retention of moisture poor where the sand is deep and the water table is low. The depressions usually require drainage but this

draining only accentuates the problem of moisture retention on the knolls. In areas where clay occurs relatively close to the surface (3-6 feet) drainage is frequently difficult to improve.

Some farmers carry on a general type of farming on the Rubicon sandy loam where the topography is relatively level and where the subsoil is either calcareous gravel or clay. The sandy loam type is valuable during wet seasons when finer textured soils fail to produce.

Granby Series (1,300 acres)

Depressional topography on sandy outwash material leads to the development of the poorly drained profile of the Granby series. The Granby sandy loam is the only member of the series in Glengarry County. It belongs to the Dark Grey Gleisolic Soil Group and has profile characteristics as described below:

A_0 — 1-0 inch of matted leaf litter.

A_1 — 0-5 inches of very dark brown (10YR 2/2) sand or sandy loam; very friable; single grain structure; pH — 6.8

G_1 — 5-11 inches of grey (10YR 5/1) sand; very friable; single grain structure; pH — 6.8

G_2 — 11-33 inches of grey (10YR 5/1) sand mottled with rusty brown; friable; single grain structure; pH — 6.9

C — Grey (10YR 6/1) sand stratified with some clay and silt; no free carbonates; pH — 7.0

At a depth of three feet or more, clay may be present but it has no obvious effect on the profile developed nor on the productivity of the soil. The native vegetation is elm, soft maple, cedar, and willow.

The natural surface soil is well supplied with organic matter that may be lost rapidly when the soil is drained and cultivated. The content of available plant nutrients is also low.

Agriculture

The native vegetation has been removed from much of the area but when the uselessness of the soil for farming was realized, the area was allowed to revert to the production of scrub willow. The soil is one of the poorest types in the County and is probably serving its best purpose in producing trees. Fortunately there is only a small acreage of Granby in Glengarry County.

If drainage and fertility are improved, good crops of hay and pasture can be produced. When drainage is improved, however, the soil tends to be droughty as a result of its coarse texture.

(2) Fine Sand.

There is a small acreage of water-laid fine sands in Glengarry County. These materials are lower in lime than the coarser sands. Soils developed from fine sands are classified in the St. Thomas series, well drained, and L'Achigan, imperfectly drained.

St. Thomas Series (100 acres)

The St. Thomas series has developed on well drained undulating fine sand under a vegetation dominated by pine. The St. Thomas fine sandy loam is the only type mapped. It belongs to the Podzol great soil group. A profile description is given below:

A_e — 0–3 inches of dark grey (10YR 4/1) fine sandy loam; friable; fine crumb structure; pH — 5.4–6.0

A_2 — 3–5 inches of grey (10YR 7/1) fine sand; single grain structure; pH — 5.4–6.0

B_2 — 5–11 inches of dark yellowish brown (10YR 5/6) friable fine sandy loam; fine nuciform structure; pH — 6.0

B_3 — 11–23 inches of yellow (10YR 7/6) fine sand; single grain structure; pH — 6.0

C — Very pale brown (10YR 7/3) fine sand; pH — 6.0

The soil materials are permeable; although layers of very fine sand and silt may be present in the C horizon; hence when denuded of vegetation, wind and water erosion may occur.

In cultivated areas the ashy grey A_2 horizon is usually mixed in the A_e horizon. The cultivated horizon is low in organic matter.

Agriculture

Much of the small acreage of St. Thomas fine sandy loam in Glengarry County has been cleared and is used for pasture production. Heavy fertilization and liming are required for satisfactory crops on this soil. Barnyard manure and green manure treatments help to maintain the organic matter content of the soil.

L'Achigan Series (3,100 acres)

The L'Achigan series is the imperfectly drained member of the St. Thomas catena. One type only, the L'Achigan fine sandy loam has been mapped. It is a Ground-water Podzol soil developed on level to gently sloping topography. An undisturbed profile is described below:

A_0 — 2–0 inches of partially decomposed vegetable matter

A_1 — 0–3 inches of very dark grey (10YR 3/1) fine sandy loam; friable; fine crumb structure; pH — 5.0

A_2 — 3–5 inches of grey (10YR 6/1) fine sand; single grain structure; pH — 4.8

B_2 — 5–10 inches of yellow-red (7.5YR 5/6) fine sandy loam; some mottling; friable; weak crumb structure; evidence of weak ortstein formation may be found in some areas; pH — 5.4

B_3 — 10–18 inches of yellowish brown (10YR 5/4) fine sand; very friable; single grain structure; pH — 5.6

C — Light brownish grey (10YR 6/2) fine sand; pH — 5.8

In the cultivated soil, remnants of the A_2 horizon are thin and may be entirely incorporated into the plow layer. The imperfect drainage and low fertility combine to make this soil of low agricultural value.

Agriculture

Artificial drainage improvement is seldom warranted on this soil because of its low natural fertility and low organic matter content. Some areas are used for hay and pasture production. L'Achigan fine sandy loam, however, is generally more useful in producing trees.

D. Soils Developed from Sorted Outwash Materials Underlain by Lacustrine Material within three feet.

In some areas, the lacustrine clay materials are covered by a thin veneer of coarse textured material. The depth of the sandy overburden varies from six inches to three feet and in some places, the clay appears at the surface. In general, the profile is developed in the coarser materials although clay may occur in the B horizons and lower.

Such sand-over-clay complexes have been classified in the Manotick Catena in Stormont County. In Glengarry County, however, only the poorly drained member, Allendale series has been mapped.

Allendale Series (8,200 acres)

The Allendale series is the poorly drained member of the Manotick catena. The topography is level to slightly undulating. The Allendale sandy loam is the only type recognized. The depth of sandy overburden varies somewhat resulting in variations in the drainage condition. The drainage is generally poor, both internal and external. The soil belongs to the Dark Grey Gleisolic Great Soil Group and exhibits profile characteristics described below:

A_1 — 0–6 inches of very dark brown (10YR 2/2) sandy loam; fine granular structure; very friable; stonefree; high in organic matter; pH — 6.4

G_1 — 6–9 inches of grey (10YR 6/1) sand or sandy loam; very friable; single grain structure; some mottling; pH — 6.4

G_2 — 9–25 inches of grey (10YR 6/1) sand; friable; single grain structure; intensely mottled with rusty reddish brown; pH — 6.5

C — 25–36 inches of grey (10YR 6/1) sand; friable; single grain structure; non-calcareous; pH — 6.8

D — Grey clay or clay loam; plastic; massive structure; pH — 7.0

In common with the other members of the catena, the profile of the Allendale sandy loam is developed within the sandy materials. The clay material may have some influence on the moisture relationships.

The natural vegetation consisted of elm, ash, and poplar. Much of the type is cleared, and remains as permanent pasture.

The organic matter is not well incorporated with the mineral fraction. In some areas, it has accumulated to such an extent that the soil is similar to shallow muck. Improved drainage and careful cultivation result in a grey-brown surface soil of medium to low fertility.

A typical soil profile of Allendale sandy loam. Note heavier textured material immediately below the grey layer.

Agriculture

The common use for the soil type is the production of permanent pasture or trees. Some cereal grains, especially buckwheat, are grown to a limited extent.

Because of the proximity of the clay, the Allendale soil rates higher than the Granby series as far as crop production is concerned. The sand-clay complex makes artificial drainage improvement difficult and renders a uniform method of tillage and management impractical since the better drained knolls require a different treatment from that of the poorly drained depressions. Where drainage is improved, fertility needs and organic matter retention require careful attention.

Where small areas of Allendale sandy loam occur within areas of better drained soils, it is useful for pasture production, alsike clover being one of the important pasture species that thrives on this soil.

E. Soils Developed from Deltaic Fine Sands and Silts

In the southern part of Lancaster and Charlottenburg townships there is a large expanse of land where, except for occasional ridges, the till plain has been buried

beneath medium to fine water-laid deposits. These materials probably were deposited by still or very slowly moving water at the time of the recession of the Champlain Sea. The soils of this area are level, inadequately drained, and stonefree. Although numerous small streams drain from this area to the St. Lawrence River, many of the soils are poorly drained. The very level topography, the pervious nature of the upper strata of the soil, and the impermeable clay layer at relatively shallow depths contribute to a water-logged condition. Again a lack of suitable outlets complicates any artificial drainage programme. It is probable that a network of deep ditches, in spite of its many disadvantages, would solve this problem.

The soil materials of this area are only moderately well supplied with lime, ranging in reaction from about neutral to slightly acid. Many fragments of amber coloured mica are found in these materials. Many of the soils are characterized by moderately low fertility, although generally response is obtained from drainage as well as from fertilization. Good farming practices are required to maintain soil organic matter and structure. The return of barnyard manure and the incorporation of green manure crops are recommended.

Castor Series (7,300 acres)

No well drained series has been mapped on the deltaic sands and silts in Glengarry County. The Castor series is the imperfectly drained member of the Castor catena. Two types, Castor very fine sandy loam and Castor silt loam, have been recognized and mapped. In addition a small acreage of Castor very fine sandy loam-shallow phase has been mapped. The dominant natural vegetation is maple, elm, and some bur oak. The profile exhibits the characteristics of a weakly developed Ground-water Podzol. The following description is of a virgin profile located in Charlottenburg township.

A_0 — Shallow layer of raw organic materials

A_1 — 0–4 inches of very dark grey (10YR 3/1) fine sandy loam; friable; fine crumb; pH — 6.4

A_2 — 4–9 inches of light brownish grey (10YR 6/2) very friable; fine sandy loam; pH — 6.4

B — 9–19 inches of brown (10YR 5/4) mottled silt loam; friable; fine to medium weak sub-angular blocky structure; pH — 6.6

C — Light brown-grey (10YR 6/2) fine sand and silt, occasionally occurs in narrow layers; pH — 6.3

D — Clay often occurs at 30–36"

The surface reaction of the Castor series varies from about neutral to medium acid. The underlying material may be stratified and frequently grades into massive grey clay at about three feet. External and internal drainage are imperfect. Along the banks of the Raisin River, some moderately well drained areas have been included with the Castor series. Topography is smooth very gently sloping. In isolated instances, slight gully erosion has occurred where drainage water has cut through the sod cover. The profile is free of stones.

Agriculture

The Castor very fine sandy loam produces fair to good yields of most farm crops. Dairy farming is the main agricultural practice on this soil. The physical character of this soil makes cultivation relatively easy. Although impeded drainage does limit the range of crops that can be grown, cereal grains, corn, and hay and pasture are produced with good success. In many cases, liming will be required for the growth of legumes such as alfalfa and clovers. Good response can be expected, in most instances, from additions of commercial fertilizer. Organic matter maintenance may be a problem on cultivated soils. The return of barnyard manure to the soil and the plowing down of green manure crops are good practices on any soil. Care should be taken on this soil to prevent gully erosion in drainage channels where surface run-off occurs.

Castor Fine Loam, Shallow Phase (400 acres)

A shallow phase is mapped in association with the Castor fine sandy loam in areas where the underlying clay is within two feet of the surface. The proximity of the clay layer to the surface results in a moderately poorly drained condition on this soil. The utilization of the shallow phase is quite similar to that of the normal phase. However, the slightly poorer drainage puts a further limitation on the number of different crops that can be grown.

Castor Silt Loam (300 acres)

The Castor silt loam is the other member of the Castor series. It differs from the fine sandy loam type only in the slightly finer texture of the surface soil. The silt loam probably has a slightly higher natural fertility than the fine sandy loam. Most crops grown on the fine sandy loam can be grown with equal success on the Castor silt loam.

Bainsville Silt Loam (19,200 acres)

The Bainsville silt loam mapped for the first time in Glengarry County, is the poorly drained member of the Castor catena. It supports a natural vegetation of elm, pine, aspen, and grey birch and exhibits characteristics of the Dark Grey Gleisolic Great Soil Group. A description of a typical undisturbed profile follows.

A_0 — 1–0 inch of leaf litter and twigs

A_1 — 0–6 inches of very dark grey (10YR 3/1) friable; fine granular, silt loam; pH — 6.3

G_1 — 6–12 inches of greyish brown (10YR 5/2 slightly mottled; friable; laminated fine sand and silt; pH — 6.5

G_2 — 12–22 inches of greyish brown (10YR 5/2) mottled; brown (10YR 5/3) fine sand and silt; friable; laminated; pH — 6.6

C — Fine sand and silt; light brownish grey (10YR 6/2); layered; pH — 6.8

D — Clay often occurs at about three feet

The Bainsville silt loam occurs on smooth level topography. External drainage is poor; internal drainage is moderately poor to poor depending on the depth to the clay layer. The profile is stonefree and the soil has not suffered noticeably from erosion. In very poorly drained locations organic matter tends to accumulate in the surface and the profile approaches that of an organic soil.

Agriculture

Most of the Bainsville silt loam has been cleared and is used in the production of general farm crops, particularly cereal grains and hay and pasture for the support of dairy cattle. Fodder corn is also grown with fair success. Artificial drainage and liming are usually required for successful stands of alfalfa and most other legumes. Adequate fall for tile drains is difficult to obtain on this soil. Open ditches may be the best solution to the drainage problem.

This stonefree, silt loam is an easily tilled soil that generally responds well to artificial fertilization. Under improved drainage conditions, organic matter may tend to become depleted and good manurial practices are recommended to help prevent this serious loss.

F. Soils Developed from Deltaic Fine Sands and Silts Underlain by Lacustrine Clay within three feet

As the fine sands and silts of the Lancaster flats grade into the clay plains, transitional soils occur which have a shallow mantle of fine sand and silt overlying the clay. This overburden is very similar to the materials of the Castor catena and varies in thickness from a few inches to not more than two feet. The underlying material is neutral to slightly acid, massive, impervious grey clay.

Marionville Series (6,000 acres)

This soil has developed from shallow, deltaic fine sands and silts low in lime underlain by heavy grey clay. The natural vegetation appears to have been predominantly elm, red maple, and black ash. The natural drainage condition is poor and the profile exhibits the characteristics of the Dark Grey Gleisolic soils. The Marionville silt loam is the only member of the series in Glengarry County. A description of a profile follows:

A_1 — 0–5 inches of very dark grey (10YR 3/1) fine sandy loam or silt loam; friable; crumb structure; stonefree; medium in organic matter content; pH — 7.0

G_1 — 5–11 inches of grey (10YR 5/1) silt loam or very fine sandy loam; friable; granular structure; pH — 6.8

G_2 — 11–19 inches of grey (10YR 6/1) silt loam; weakly plastic; weak blocky structure; intensely mottled; pH — 7.0

G_3 — 19–36 inches of grey (10YR 6/1) clay loam; plastic; massive structure; mottled with rusty brown (10YR 5/3); pH — 7.0

C — Grey (10YR 6/1) clay or clay loam; very plastic; massive structure; non-calcareous; pH — 7.2

The C horizon is very similar to that of the North Gower series. It is difficult to determine the true parent material of this soil. The upper horizons are so coarse in texture (fine sandy loam) that it is unlikely that they were derived from the underlying C horizon material. The coarser material presumably is depositional overburden that is too shallow to allow a complete profile to develop within it. Hence, the profile extends through the overburden into the underlying lacustrine material. The

Bainville silt loam is a stonefree soil of medium texture with fine clay at three feet below the surface.

lower part of the glei horizon is developed in the fine material. The C horizon then is the parent material of the lower horizons but not of the surface horizons.

The cultivated surface soil is a grey-brown fine sandy loam fairly well supplied with organic matter. In some areas, the G_1 horizon has become mixed with the A_1 resulting in a lighter colour in the surface layer.

Agriculture

Drainage is an important factor in the utilization of this soil type. With the installation of deep ditches and tile drains, however, much of the area can be used for general farming. The chief crops grown are hay and pasture with some acreage devoted to small grains.

G. Soils Developed on Lacustrine Materials

Lacustrine materials are of medium to fine texture having been deposited by still or very slowly moving water. As the glacier receded, much of this eastern portion of Ontario was inundated by glacial Lake Champlain and Gilbert Gulf. The particles

carried by the water flowing into the lake gradually settled to the lake bed. The farther retreat of the ice allowed the lakes to drain and so today only the beds of the lakes remain. The fine textured lacustrine plains represent the lake beds of late glacial times.

Over forty per cent of Glengarry County is occupied by fine textured soils developed from lacustrine deposits. The neutral silt loams and clays occur mainly in the south-western parts of the County. In Kenyon and Lochiel townships are found relatively large areas of brown and grey stratified clay. Smaller areas of slightly acid grey clays occur in Lancaster township and shallow lacustrine deposits underlain by fine sand and silt are found near Glen Gordon. The soils developed from these materials are imperfectly to poorly drained, medium in organic matter, and relatively fertile. Some of the better agricultural areas of the County are located on these soils.

1. Neutral Silt Loams

The neutral, medium textured lacustrine deposits of Glengarry County occur in association with heavier lacustrine materials and till or gravel ridges. It is probable that the medium texture results from the admixture of coarser materials from the ridges with fine clay sediments of the lacustrine plains. The soil materials are usually stratified and heavy clay often occurs at depths of about four feet. The Osgoode series is the only one occurring on these materials in Glengarry County.

Osgoode Series (16,200 acres)

Only poorly drained Dark Grey Gleisolic soils occur on the neutral silt loam of Glengarry County. These soils are mapped as the Osgoode series. Two members of the series, Osgoode silt loam and Osgoode silty clay loam have been mapped. The natural vegetation is predominantly elm, ash, and soft maple.

Osgoode silt loam (14,700 acres).

Osgoode silty clay loam (1,500 acres).

The following is a description of the silt loam profile under the original forest cover:

A_0 — ½–0 inch of matted leaf litter

A_1 — 0–6 inches of dark grey (10YR 4/1) silt loam; friable; fine granular structure; stonefree; no free carbonates; medium to high in organic matter; pH — 7.0

G_1 — 6–9 inches of light brownish grey (10YR 6/2) silt loam; friable; weak medium sub-angular blocky structure; some weak mottling; no free carbonates; stonefree; pH — 6.8

G_2 — 9–21 inches of grey-brown (10YR 5/2) silt loam; weakly plastic; massive structure; mottled; stonefree; no free carbonates; pH — 7.0

C_1 — Grey (10YR 5/1) silt loam; plastic; massive structure; mottled; free carbonates may be present; pH — 7.4

The parent material may have lenses or layers of sandy material intermixed with layers of clay but no stones are present. The topography is level to depressional.

Osgoode silt loam — a poorly drained soil developed in water-laid material.

The natural vegetation consisted of soft maple, elm, and ash. Under natural conditions, the surface soil is fairly high in organic matter which it retains under cultivation if reasonably well managed.

Agriculture

For the most part the Osgoode soils occur in small areas in Glengarry County and are used for pasture. The fertility level is medium but the restricted drainage is a limiting factor. The drainage problem can be overcome, however, by installation

of open ditches and tile drains. The type does not occur in large areas; hence any one farm is not likely to be all Osgoode silt loam or silty clay loam. Hay (red clover and alsike), pasture, and cereal grains are crops commonly grown on this soil. Osgoode silt loam or silty clay loam in association with a well drained soil type is an ideal combination for dairy farming.

2. Grey Clay, Calcareous

These materials occur in relatively small areas widely distributed throughout the County. The poorly drained North Gower series and the very poorly drained Belmeade series are the only ones mapped.

North Gower Series (21,000 acres)

The North Gower series includes fine textured soils of neutral to slightly alkaline reaction that are poorly drained.

The level to depressional topography inhibits drainage. The North Gower clay loam and North Gower clay are members of the series mapped in the County. They belong to the Dark Grey Gleisolic Soil Group. A description of a virgin profile is presented below:

North Gower clay loam (13,400 acres).

North Gower clay (7,600 acres).

A_0 — ½–0 inch of matted leaf litter

A_1 — 0–8 inches of very dark grey (10YR 3/1) clay loam; friable; medium crumb structure; stonefree; medium to high in organic matter; pH — 7.0

G_1 — 8–12 inches of grey (10YR 5/1) clay loam; plastic; fine blocky structure; mottled; stonefree; pH — 7.0

G_2 — 12–26 inches of grey (10YR 5/1) clay loam; plastic; fine blocky structure; intensely mottled; stonefree; pH — 7.2

C — Grey (10YR 6/1) silty clay loam; plastic; massive structure; stonefree; free carbonates present; pH — 7.4

The parent material is usually stonefree although some grit may be present. The poor drainage results in horizons that are very indistinct and mottling often occurs immediately below the dark coloured A_1 horizon.

The natural vegetation consisted of elm, ash and soft maple. The organic matter content of the surface soil is medium to high and it is well incorporated with the mineral matter. The cultivated soil is very dark brown in colour with a medium to high fertility. The phosphorus and potash contents of the North Gower series are appreciably higher than those of comparable lacustrine deposits in Western Ontario.

Agriculture

A large percentage of this type in Glengarry County has been cleared and is being used for permanent pasture production with no improvement in drainage.

Cereal grains and some corn are grown, however, where ditches and tile drains have been installed.

North Gower clay loam — a highly productive soil when artificially drained.

General farming and dairying are common especially where well drained till areas occur in association with the lacustrine material. Cereal grains and alfalfa may be grown on the till soil while the poorly drained areas may be used for pasture and hay. The production and utilization of the North Gower clay loam varies greatly with the season. The soil is naturally poorly drained and, therefore, during a wet season its agricultural value is greatly decreased. Conversely, if the season is dry, the fine textured soil holds moisture better than the coarser soils and better crops result.

North Gower Clay (7,600 acres)

The North Gower clay is generally more poorly drained than the clay loam. The clay type often occurs in narrow valleys close to stream courses and is usually used

for hay or permanent pasture production. The lateness of this soil in the spring practically prohibits the growing of corn or cereal grains if artificial drainage is not provided.

3. Stratified Brown and Grey Clay

In central and northern Glengarry, there are large acreages of clay plains in which the parent soil materials are heavy, waxy, low lime clays, similar to the stratified brown and grey clays of Prescott and Russell Counties. These materials show indistinct bands of reddish brown clay alternating with bands of brownish grey clay. The soils developed on these materials are classified in the Wendover and Bearbrook series.

Wendover Series (1,800 acres)

The Wendover series is the imperfectly drained member of the Wendover catena. Developed on low lime stratified brown and grey clay under a maple and elm vegetation, the soil is classified as a weakly developed Grey-Brown Podzolic although it has many features of a Regosol. The Wendover clay is the only member of the series in Glengarry County. The following description is of a cultivated profile occuring in Lochiel township.

A_c — 0–5 inches of very dark grey (10YR 3/1) moderately friable clay; medium granular structure; pH — 6.3

A_3-B_1 — 5–8 inches of indistinctly formed horizon; brown (10YR 5/3) clay; medium nuciform; pH — 6.3

B_2 — 8–16 inches of brown (10YR 5/3) clay; hard; large blocky structure; some mottles; pH — 6.6

C_1 — Heavy greyish brown clay.

C_2 — Heavy, waxy, blocky, clay; greyish brown (10YR 5/2) with faint bands of reddish brown clay (5YR 4/3) pH — 7.0

Occurring on gently sloping topography in association with stream courses, the Wendover clay is subject to serious gully erosion if not carefully managed. The internal drainage is imperfect but the surface run-off prevents serious water logging of the soil.

Profile development varies slightly with drainage. The better drained sites in close association with stream courses, tend to have slightly more distinct profile development than the areas farther back from the streams. The profile is stonefree. The layering of colours in the parent materials is indistinct and may not be found in some profiles.

Agriculture

Most of the Wendover clay has been cleared and is used for agricultural production. Fair to good crops of cereal grains are produced and grasses for hay and pasture yield well on this soil. Liming may be required in many cases for successful stands of alfalfa and clovers. Long rotations containing plenty of grasses are recommended to help prevent serious depletion of soil organic matter. Special care often is required to prevent gully erosion on susceptible areas.

Bearbrook Series (41,400 acres)

Bearbrook clay developed from stratified low lime brown and grey clays under poor drainage conditions. It is the poorly drained member of the Wendover catena. The profile, characteristic of the Dark Grey Gleisolic Great Soil Group, developed under a forest vegetation of elm and red maple. A typical cultivated profile located in Kenyon township is described below:

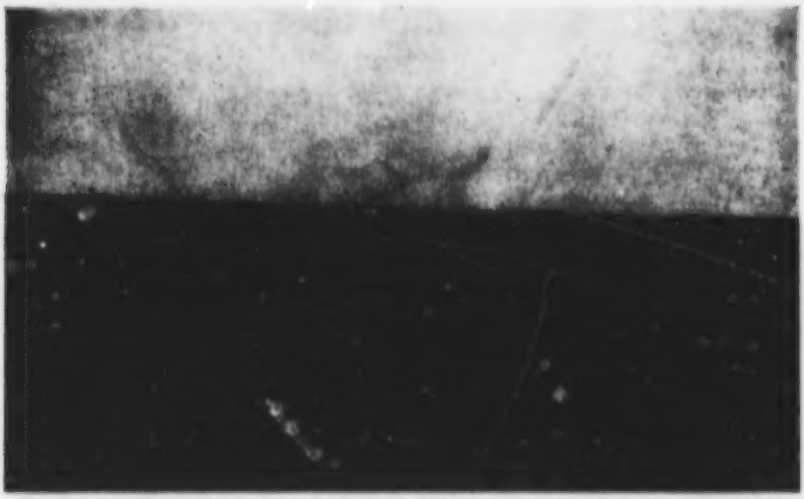
A_e — 0–5 inches of very dark brown (10YR 2/2) moderately friable; medium granular; clay; pH — 6.7

G_1 — 5–11 inches of mottled brown (7.5YR 5/4) clay; plastic; massive structure; pH — 6.8

G_2 — 11–23 inches of mottled brown (10YR 5/4) clay; plastic and massive; mottles more intense than in G_1 horizon; pH — 6.8

C — Heavy waxy light brownish grey (10YR 6/2) and reddish brown (5YR 4/3) clay; weakly banded; plastic; no free carbonates; pH — 6.9

The banding in the parent materials of the Bearbrook is indistinct and occasionally absent. The profile often assumes a brownish cast throughout, probably the result of the nature of the underlying clay. The topography is level and both internal and external drainage are poor. The profile is stonefree. North of Glen Robertson there is a small area of Bearbrook clay that has carbonates in the parent material and often in the surface.



Bearbrook soils are flat and poorly drained. Fine texture makes drainage difficult but necessary for good production of general farm crops.

Agriculture

Although poorly drained, this soil is often low in organic matter. Thus deterioration of structure on cultivation is not uncommon. Plowing down of green manure and returning farmyard manure to the soil help to prevent this impairment of structure.

The Bearbrook clay responds well to artificial drainage. The soil is very slow to warm up in the spring and often seeding of spring grains is prevented. When drained this soil produces fair to good yields of most farm crops in normal years. Good stands of grasses and cereal grains can be expected. Corn does only moderately well. Liming is often necessary for the successful growth of legumes.

4. Grey Clay non-calcareous.

In Lancaster township, near to the Ontario-Quebec border, there is an area of clay soil developed from massive grey marine clay that is neutral to slightly acid in reaction. The parent materials are stonefree and do not effervesce with dilute hydrochloric acid. Soils developed on this type of materials have been mapped in Carleton and Russell Counties and classified in the Rideau catena. Only the poorly drained member of the catena has been recognized and mapped in Glengarry County.

Ste. Rosalie Series (1,700 acres)

The Ste. Rosalie clay is the poorly drained member of the Rideau catena developed on the low lime grey clays. The natural forest vegetation has been elm, red maple, and some pine. The profile exhibits Dark Grey Gleisolic characteristics. The following description is of a typical profile in Lancaster township.

A_e — 0–6 inches of very dark grey (10YR 3/1) clay; moderately friable; medium granular structure; pH — 6.5

G_1 — 6–10 inches of mottled greyish brown (10YR 5/2) clay; plastic; massive; pH — 6.7

G_2 — 10–20 inches of greyish brown (10YR 4/2) conspicuously mottled with many rust coloured mottles; massive; pH — 6.8

C — Fine clay, tends to break out in large blocks; colour (7.5YR 5/2) brown; pH — 6.8

The Ste. Rosalie clay occurs on level topography. Surface run-off is low and internal drainage is very slow, resulting in a poorly drained condition. The profile is stonefree. Erosion is not a hazard to land use on this soil.

H. Soils Developed from Organic Materials

1. Shallow Underlain by Clay.

In areas bordering muck land, soils may develop with a thin layer of organic material (6–15 inches thick) underlain by clay. These soils are classified in the Belmeade series.

Belmeade Series (2,400 acres)

Soils developed on materials similar to those of the North Gower series under conditions of very poor drainage are included in the Belmeade series. The topography is depressional.

The Belmeade muck is the only member of the series and it exhibits the profile characteristics of a Shallow Organic Soil. The profile that obtains under virgin conditions is described below:

A_0 — 0–15 inches of black (10YR 2/1) layer of organic matter in varying stages of decomposition; pH — 6.8

G_1 — 15–20 inches of grey (10YR 5/1) clay; plastic; massive structure; stonefree; pH — 6.8

G_2 — 20–36 inches of grey (10YR 6/1) clay; plastic; massive structure; mottled with rusty brown; stonefree; pH — 6.8

C — Grey (10YR 6/1) clay or silty clay; plastic; massive structure; stonefree; occasionally free carbonates are present; pH — 7.0

The surface horizon under cultivation is quite variable. In some areas, the native forest has been removed and the organic surface layer partially burned in an effort to improve the soil for general agriculture. The effort has been successful in some areas and the organic matter remaining has been incorporated with the mineral soil. The surface layer then becomes a very dark grey clay or clay loam about 6–8 inches deep very closely resembling that of the North Gower series.

In many areas, however, the burning has not improved the soil for crops because the organic matter was completely burned and the grey subsoil low in organic matter has become the surface soil. This layer is difficult to handle because of poor aeration and low supply of available nutrients.

Agriculture

The acreage of Belmeade muck in Glengarry County is relatively small. Much of the type is still in forest and natural pasture and probably is serving its best use in that state. Areas which have been cleared and prepared successfully for farming are used in the same manner as the areas of North Gower clay loam. Improved drainage allows the production of hay, pasture, buckwheat, and cereals in relatively dry seasons.

2. Deep Organic Deposits

Muck (22,000 acres)

There is an appreciable acreage of organic soils widely distributed in Glengarry County. All areas that have eighteen inches or more of organic material overlying the mineral soil have been classed as muck. It belongs to the Organic Great Soil Group.

Description

18 inches or more of organic layer consisting of semi-decomposed vegetative material, usually neutral to alkaline on the surface. Underlying material may be till, sand or clay.

Agriculture

Very little of the muck areas is used for general crops. The natural vegetation of elm, tamarack and cedar may be used for fuel but most of the area still remains in

the wooded condition. For agricultural production, muck soils require clearing and drainage and it is doubtful if the returns would warrant the expenditure for development under present economy.

I. Soils Developed From Recent Alluvium

Bottom Land (19,400 acres)

The complex of soil conditions adjoining stream courses is called Bottom Land. Such land is subject to flooding and hence a great variety of alluvial material has been deposited. The reaction, texture, and profile characteristics are extremely variable.

Agriculture

The chief use of the soil is for the production of permanent pasture.

PART IV

EARLY SETTLEMENT AND AGRICULTURAL DEVELOPMENT

Glengarry County was first entered by white people about the year 1784 by United Empire Loyalists from New York State who emigrated following the American Revolution. Several parties of settlers from Scotland followed in succeeding years. By 1794 all four townships had been entered, Kenyon being the last to be settled. The St. Lawrence River to the south supplied trade connections with Montreal and up until 1882 most of the County's produce was shipped by water or on the Grand Trunk Railway from Lancaster. In 1882 the Ottawa to Montreal rail line was built and Alexandria (formerly Priests' Mills) became the centre of trade for the County. It was incorporated as a village in 1883 and as a town in 1902.

The first churches in the County were built at Lancaster and St. Raphaels about the year 1790. One of the first stone churches was erected at Kirkhill in the middle 1860's and still stands.

The first newspaper published in Glengarry was the "Glengarry Times" at Lancaster in 1881. However, it was short lived. The "Glengarry News" established in 1897, and the "Times" (1915) are still publishing in Alexandria.

Timber, lumber and some pulpwood furnished a livelihood for the early settlers. As the land was cleared it came into use for agricultural purposes. The first agriculture was of a subsistence nature, each farm producing according to the needs of the people. As the land was developed, dairy farming was practised and now Glengarry has long been noted for its milk and cheese production. As early as 1881 there were seventeen cheese factories and three creameries in the County. At present, the number of small cheese factories is gradually declining due to competition from large scale milk-processing plants.

Although the amount of maple sugar and syrup produced in Glengarry County is declining, these products have, in the past, provided an important source of supplemental income. In the early 1890's production reached a maximum of about 600,000 gallons of syrup per year. The corresponding figure for 1940 is about 20,000 gallons.

According to the Ontario Agricultural Commission Report of 1881, Glengarry County farmers used no artificial fertilizers at that time and only small areas of land had been drained.

PRESENT AGRICULTURE AND LAND USE

Glengarry County lies in the milk producing area of Eastern Ontario. The predominant present agricultural practice is summer dairying. The land is used in the production of such crops as are required of such a system of farming. Other agricultural endeavours of lesser importance in the County are swine and poultry raising, grass seed and flax production. Other products as potatoes and maple syrup account for a smaller portion of the farm income.

A large proportion of the milk was processed within the County at the many small cheese factories. Some fluid milk now finds its way to the Montreal market. Considerable income has come from the export of dairy cattle to the United States but this market has failed in recent years. Hog raising affords a convenient and economical means of using the whey which is a by-product of the cheese making

industry. In recent years the fluid milk market has expanded a great deal and local cheese factories have been abandoned.

The following tables show the present land use in Glengarry County.

TABLE 6

CONDITION OF LAND IN GLENGARRY COUNTY (1951 CENSUS)

	Acres	%
Total land area	305,920	100.0
Area of occupied farm land	264,383	86.6
Improved land	161,722	45.6
Unimproved land	102,661	33.6

The occupied farm land consists of 2,287 farms of an average acreage of about 100 acres.

The present use of occupied farm land is shown in Tables 7 and 8 for improved and unimproved land respectively.

TABLE 7

IMPROVED LAND (1951 CENSUS)

	Acres	%
Area of Improved land	161,722	100.0
Field crops	122,867	76.0
Pasture	32,814	20.4
Fallow	711	0.5
Other	5,330	3.3

Field crops and improved pasture occupy only 96 per cent of the improved land. Fifty-nine acres are used for fruits and vegetables according to the 1951 Census.

TABLE 8

UNIMPROVED LAND (1951 CENSUS)

	Acres	%
Area of unimproved land	102,661	100.0
Woodland	41,529	40.5
Marsh and Waste	61,132	59.5

Approximately one-half of the unimproved land is used as natural pasture. Forty and one-half per cent of the unimproved land (12.8% of the total area of the County) remains as woodland.

The Statistics Branch of the Ontario Department of Agriculture reports the following acreages of field crops in Glengarry County in 1955.

TABLE 9

ACREAGE OF FIELD CROPS IN GLENGARRY COUNTY (1955)

	Acres
Hay	75,800
Oats	39,300
Barley	1,950
Wheat	500
Mixed grain	5,200
Buckwheat	2,800
Rye	200
Corn	3,300
Potatoes	300
Total Field Crops	129,580

The acreage of field crops varies somewhat from year to year. The 1941 Census of Canada reports 129,594 acres of field crop in Glengarry County. Small differences can be noted in the amounts of each crop. Significant is the change in the flax acreage during the period 1941-1949. While the 1941 Census reports 1,037 acres of flax, the 1949 Statistics list only 30 acres and none in 1955. This marked change probably is due to alterations in the market and the labour supply.

The statistics quoted above indicate the cropping system of the County which emphasizes hay and pasture for dairy cattle along with cereal grains, chiefly oats.

About 38.2 per cent of the total improved land is in hay each year. Of the total hay, only about 12.4 per cent is alfalfa, which reflects the large area of poorly drained soil which is not suitable to alfalfa production. Large acreage of improved and natural pasture are used for summer grazing.

Crop Adaptability Ratings and Land Use Management

Of the various factors that affect soil productivity, climate is one than cannot be altered. Fortunately, the climate of Glengarry County is suitable for the production of a wide range of crops. In addition to such general farm crops as oats, barley, alfalfa, timothy, hay and pastures, specialized crops such as apples are produced in some areas. The successful production of any crop depends on the suitability of the soil to produce that crop. The simplest method of soil conservation and good land use management is the selection of crops that produce most efficiently and economically on the soil types available.

The potentialities and limitations of the soil types for crop production have been discussed in Part III. The comparative adaptability of individual soil types for selected crops grown in the area is a useful beginning for better land use management. The soil type is specific in character having more or less constant chemical and physical properties. Such features as drainage, topography, erodability, and stoniness as well as organic matter content, texture, structure, reserve supply of nutrients and water are evaluated in determining the comparative adaptability of a soil for a certain type of crop production.

The limitations of such crop adaptability rating must be realized in the beginning.

It is a theoretical rating based on a consideration of the natural fertility and productivity of the soil under the prevailing system of management in relation to the requirements of the crop concerned. The absolute rating of crop adaptability under specific management must be obtained from average yields over a significant number of years. The introduction of new varieties of crops, new management practices, market variations or other unforeseen factors may necessitate adjustments or changes in some of the ratings.

On the basis of the best information available from soil workers, agronomists, and farmers, as well as on observations made during the survey, the soils of the County have been arranged into six adaptability groups and rated for nine crops commonly grown in the area. Because of the marked influence that the amount of rainfall exerts on the adaptability of the soils of the area separate ratings are presented for a normal and a wet season.

Group 1 — Good Cropland

Soil Type	Acreage	% Total Acreage of County
Eamer loam	48,300	15.8
Grenville loam	65,800	21.5
Osgoode silt loam	14,700	4.8
Osgoode silty clay loam	1,500	0.5
North Gower clay loam	13,400	4.4
Total	143,700	

A large portion of Glengarry County is classed as good cropland. The soils included in this group provide the most economical production of the common crops under the prevailing systems of management. The till soils of the group (Eamer and Grenville) have a general disadvantage in that they are susceptible to erosion when brought under cultivation. The Eamer loam with its strongly undulating to gently rolling topography has the most serious erosion hazard. Normal good management, however, with adequate crop rotation on the steeper slopes suffices to stabilize the soil. Stones on the Eamer and Grenville loams may be so numerous that they must be removed to allow efficient cultivation. Although these soils may not produce highest yields, they are capable of producing a wide variety of crops.

The remainder of the soils of the group are stonefree, fine textured, and tend to be inadequately drained. The simple installation of open ditches and tile drains however, allows good crop production in most seasons

This group of soils has a naturally high fertility and organic matter content that can be easily maintained. Parcels of land that include both well drained and inadequately drained members of this group provide good returns for the operator who specializes in dairying.

TABLE 10

*CROP ADAPTABILITY RATINGS FOR GOOD CROPLAND

Soil Type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Ramer loam	G–F	G–F	G–F	G–F	G	G–F	G	G–F	G–F	G	F	F–P	G	G	G	G–F	G–F	G–F
Grenville loam	G–F	G–F	G–F	G–F	G–F	G–F	G	G–F	G–F	G	G–F	F	G	G	G	G–F	G–F	G–F
Ogdensburg silt loam	G	G–F	G	G–F	F	F–P	G–F	F	G	G	F	F–P	G	G–F	G–F	F	G	G
Ogdensburg silty clay loam	G	G–F	G	G–F	F	F–P	G–F	F	G	G	F	F–P	G	G–F	G–F	F	G	G
North Gower clay loam	G	F	G	F	F–P	P	G–F	F	G	G	F–P	P	G–F	F	F	F–P	G	G

N.S — Normal Season

W.S. — Wet Season

*Crop adaptability ratings for each soil type as follows:

G—Good; G–F—Good to Fair; F—Fair; F–P—Fair to Poor; P—Poor.

Group II — Good to Fair Cropland

Soil Type	Acreage	% Total Acreage of County	Chief Limitations
Wendover clay	1,800	0.6	impermeable subsoil
Castor very fine sandy loam	6,600	2.1	drainage and fertility
Castor silt loam	300	0.1	drainage
Matilda loam	5,800	1.9	dr... age
Bainsville silt loam	19,200	6.3	drainage
Marionville silt loam	6,900	2.2	drainage
North Gower clay	7,600	2.5	drainage and poor soil structure
Ste. Rosalie clay	1,700	0.5	drainage and poor soil structure
Bearbrook clay	41,400	13.5	drainage, low lime
Grenville loam-shallow phase	4,200	1.4	droughtiness, shallow rooting zone
Total	95,400		

The Manotick sandy loam, in particular, requires the addition of some commercial fertilizer and care in the conservation of organic matter for good crop production. Improved drainage is required on many of the soils in this group. In this respect, the Matilda loam has the disadvantage of being stony, a condition that makes drainage expensive and in some instances impractical.

The above limitations combine to increase the cost of crop production on the soils of the group thereby decreasing the net returns for the farmer.

TABLE 11

*CROP ADAPTABILITY RATINGS FOR GOOD TO FAIR CROPLAND

Soil Type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Wendover clay	G–F	F	G–F	F	G–F	F	G–F	F	G	G	G–F	F	G–F	G–F	G–F	F	G	G
Castor very fine sandy loam	G–F	F	G–F	F	F	F	G–F	F	G	G	G–F	F	G–F	G–F	G–F	F	G	G
Castor silt loam	G–F	F	F	F	F	F	F–G	F	G	G	F–P	P	G–F	F	G–F	F	G	G
Matilda loam	G–F	F	G–F	F	F	F	F–G	F	F–G	F–G	F	F–P	F	F	F	F–P	G	G–F
Bainsville silt loam	G–F	F	F	F	F	F	F	F	G–F	F	F–P	P	F	F	F	F	G–F	F
Marionsville fine sandy loam	G–F	F	F	F	F	F–P	F	F–P	G	G–F	F–P	P	G–F	F	F	F–P	G	G
North Gower clay	G–F	F	F	F	F	F–P	F	F–P	F	F	P	P	G–F	F	F	F	G	G–F
Grenville loam-shallow phase	F	F	F	F	F–P	F–P	F–P	F–P	F	F	F	G–F	F	F	F	F	F	G–F
Ste. Rosalie clay	G–F	F	F	F	F	F–P	F	F–P	G	G–F	F–P	P	G–F	F	F	F–P	G	G
Bearbrook clay	G–F	F	F	F	F	F–P	F	F–P	G	G–F	F–P	P	G–F	F	F	F–P	G	G

N.S.—Normal Season

W.S.—Wet Season

*Crop adaptability ratings for each soil type as follows:

G—Good; G–F—Good to Fair; F—Fair; F–P—Fair to Poor; P—Poor

Group III — Fair Cropland

Soil Type	Acreage	% Total Acreage of County	Chief Limitations
Kars gravelly sandy loam ..	7,600	2.5	fertility and erosion susceptibility
Uplands sandy loam	200	0.1	fertility, low moisture
St. Thomas fine sandy loam	100	0.1	fertility, low moisture
Rubicon sandy loam	3,000	1.0	fertility and drainage
L'Achigan fine sandy loam	3,100	1.0	fertility and drainage
Total	15,000		

The lack of fertility and adequate drainage is a rather serious hindrance to crop production. Hence, the soils of this group must be considered as only fair cropland.

All of the soils are coarse textured, are low in fertility and lose organic matter rapidly under cultivation. The Kars soil type is developed on rolling topography and hence has an erosion problem on the slopes.

Special attention must be paid to organic matter maintenance on the soils of this group. Fortunately, the dairy type of farming in the area provides material for the above purpose. The Rubicon, Uplands, St. Thomas and L'Achigan soils often respond to applications of lime.

The soils are well suited to potato production and are useful for cereal grain production during wet seasons when the finer textured soils have too much moisture. On the average, the yields of general farm crops from this group of soils are only fair under the management practices in common use in the area.

TABLE 12

*CROP ADAPTABILITY RATINGS FOR FAIR CROPLAND

Soil Type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Kars gravelly sandy loam	F	F	F	F	F–G	F–G	F–P	F–P	F	F	G–F	G–F	F–P	F–P	G–F	F–G	F–P	F–P
Uplands sandy loam	F–P	F	F–P	F	F–P	F	F–P	F	F–P	F	F	G	F–P	F	F–P	F–G	F–P	F
St. Thomas fine sandy loam	F–P	F	F–P	F	F–P	F–P	F–P	F	F–P	F	G–F	G	F–P	F	F	F	F–P	F
Rubicon sandy loam	F–P	F–P	F–P	F–P	P	P	F–P	P	F	F	F	F–P	F	F	F–P	P	F–P	F–P
L'Achigan fine sandy loam	F–P	F–P	F–P	F–P	P	P	F–P	P	F	F	F	F–P	F	F	F–P	P	F–P	F–P

N.S.—Normal Season

W.S.—Wet Season

*Crop adaptability ratings for each soil type as follows:

G—Good; G–F—Good to Fair; F–Fair; F–P—Fair to Poor; P—Poor.

Group IV — Fair to Poor Cropland

Soil Type	Acreage	% Total Acreage of County	Chief Limitations
Belmeade muck	2,400	0.8	drainage
Granby sandy loam	1,300	0.4	drainage and fertility
Lyons loam	1,800	0.6	drainage and fertility
Allendale sandy loam	1,500	0.5	drainage and fertility
Total	7,000		

The soils of Group IV are moderately to poorly suited for the production of general farm crops. As a group, the lack of drainage is an important factor limiting the productivity of the soils. In the case of the lighter textured soils, when drainage has been improved, fertility becomes a limiting factor in production. The Lyons soils have an added limitation — excessive stoniness that hinders attempts at artificial drainage as well as cultivation. The Belmeade muck soil has a deep organic layer that is often partially burned off and incorporated with the mineral soil for crop production. The above limitations and the cost of overcoming these limitations greatly increase the cost of production. Under the present system of management and at present agricultural prices, such soils must be classed as fair to poor cropland.

TABLE 13

*CROP ADAPTIBILITY RATINGS FOR FAIR TO POOR CROPLAND

Soil Type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Belmeade muck	F	P	F	P	P	P	P	P	F	F–P	P	P	F–P	P	F–P	P	F	F
Granby sandy loam	F–P	P	P	P	P	P	P	P	F	F–P	P	P	F	F–P	F	F–P	F	F–P
Lyons loam	F–P	P	F–P	P	P	P	P	P	F–P	F–P	P	P	F–P	P	P	P	F–G	F
Allendale sandy loam	F–P	P	P	P	P	P	P	P	F	F	P	P	F	F–P	P	P	F	F

N.S.—Normal Season

W.S.—Wet Season

*Crop adaptability ratings for each soil type as follows:
G—Good; G–F—Good to Fair; F—Fair; F–P—Fair to Poor; P—Poor.

Group V — Poor Cropland

Soil Type	Acreage	% Total Acreage of County	Chief Limitations
Eamer loam (bouldery phase)	3,400	1.1	stoniness
Total	3,400		

There is only a small acreage of poor cropland in Glengarry County. Also, each unit area of such land is generally small and in association with better cropland. Wherever the soils of this group occur, however, they create a problem in land use.

The bouldery Eamer loam cannot be cultivated unless the stones are removed. This is an expensive procedure and so usually the soil is left for pasture production.

Group VI — Submarginal Cropland

Soil Type	Acreage	% Total Acreage of County	Chief Limitations
Bottom land	19,400	6.3	drainage
Muck	22,600	7.4	drainage
Total	42,000		

TABLE 14

*CROP ADAPTABILITY RATINGS FOR POOR CROPLAND

Soil Type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Exeter loam (bouldery phase)	P	P	P	P	F–P	F–P	F–P	F–P	F–P	F–P	P	P	P	P	P	P	F	F

N.S.—Normal Season

W.S.—Wet Season

*Crop adaptability ratings for each soil type as follows:

G—Good; G–F—Good to Fair; F—Fair; F–P—Fair to Poor; P—Poor.

TABLE 15

*CROP ADAPTABILITY RATINGS FOR SUBMARGINAL CROPLAND

Soil Type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Bottom Land	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Muck	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

N.S.—Normal Season

W.S.—Wet Season

*Crop adaptability ratings for each soil type as follows:

G—Good; G–F—Good to Fair; F—Fair; F–P—Fair to Poor; P—Poor.

A relatively large proportion of Glengarry County is classed as submarginal cropland. The large number of meandering streams have a large acreage of bottom land associated with them. This land is subject to flooding during periods of high rainfall. Hence, permanent pasture production is the best use that can be made of such land. The muck areas which make up 13.3 per cent of the area are not used for general farming. The cost of drainage improvement and provision of irrigation facilities for market gardening is costly so that commercial development of the muck soils will be confined to small and most favourably situated areas. The unimproved muck soils are of little agricultural value.

TABLE 10

SUMMARY OF CROP ADAPTABILITY GROUPS WITH ACREAGES AND CHIEF LIMITATIONS

	Acreage	% Total Acreage of County	Chief Limitations
Group I	143,700	47.1	
Group II	93,400	31.1	drainage
Group III	13,000	4.7	fertility
Group IV	7,000	2.3	drainage, fertility
Group V	3,400	1.1	stoniness
Group VI	42,000	13.7	drainage
	302,100	100.0	

APPENDIX TABLE I

MECHANICAL ANALYSES, pH, CATION EXCHANGE CAPACITY AND ORGANIC MATTER CONTENT OF SURFACE SAMPLES OF GLENGARRY COUNTY SOILS

Soil Type	Sample No.	Location			Sand % 1-.05 mm.	Silt % .05-.002 mm.	Clay % <.002 mm.	pH (glass electrode)	Cation Exchange Capacity m.e./100gms.	Exchangeable Cations			Organic Matter %
		Township	Lot	Con.						Calcium m.e./100gms.	Magnesium m.e./100gms.	Potassium m.e./100gms.	
Allendale sandy loam	55	Charlottenburg	14	II Front	51.2	44.8	4.0	5.8	19.1	12.8	1.6	0.10	6.5
	56	Charlottenburg	7	I Front	37.6	60.0	2.4	5.7	16.2	10.1	2.1	0.05	5.6
Bainsville silt loam	3	Lochiel	19	V M	17.0	67.9	15.1	6.2	29.0	21.0	7.1	0.19	6.7
	11	Charlottenburg	17	II	17.2	67.9	14.9	6.8	23.0	24.9	3.4	0.10	5.5
	13	Charlottenburg	15	VI	19.7	67.3	13.0	5.8	12.0	7.7	1.6	0.23	3.7
	40	Lancaster	18	III M	29.7	61.2	9.1	6.1	11.6	7.4	2.6	0.05	2.9
	42	Lancaster	20	I S	24.6	68.0	7.4	6.5	22.2	19.7	3.7	0.09	6.0
	43	Lancaster	36	III S	21.3	68.5	10.1	6.3	11.7	7.7	2.1	0.04	3.2
	67	Charlottenburg	26	I N	17.4	74.1	8.5	7.1	16.6	16.5	2.7	0.08	4.7
	4	Lochiel	20	VI M	30.0	50.5	19.5	6.7	26.6	21.3	5.7	0.20	6.2
Kanor loam	15	Charlottenburg	17	X S	39.0	38.4	22.6	7.2	26.1	39.0	2.1	0.19	6.6
	16	Charlottenburg	25	X S	46.2	37.0	16.8	7.2	20.2	26.8	1.6	0.15	4.9
	36	Kenyon	1	I M	36.2	40.4	23.2	7.6	27.5	34.6	1.4	0.20	5.5
	46	Charlottenburg	30	XI N	60.5	31.4	8.1	6.3	16.1	12.7	1.9	0.39	3.5
	68	Charlottenburg	36	I N	41.9	41.5	16.6	7.2	30.2	29.8	3.8	0.17	6.9
	70	Charlottenburg	40	VI S	40.2	41.7	18.1	6.8	23.3	23.8	0.9	0.11	5.6
Grenville loam	18	Kenyon	41	II N	55.0	37.3	9.7	6.5	26.0	24.6	2.1	0.12	6.8
	27	Lochiel	9	IV M	32.2	46.4	21.4	7.2	25.0	18.3	5.8	0.20	6.1
	29	Lochiel	31	IV M	48.4	34.8	16.8	6.2	26.6	23.6	1.9	0.12	6.9
	31	Kenyon	26	IX M	43.4	44.2	12.4	7.0	21.5	24.7	1.6	0.14	5.8
	35	Kenyon	12	III N	45.3	40.2	14.5	7.2	22.7	24.0	1.4	0.17	4.7
	63	Lancaster	17	VI N	52.7	35.1	12.2	7.0	21.1	19.5	2.5	0.14	4.8
Kars gravelly sandy loam	19	Kenyon	39	VI S	55.6	31.2	13.2	7.1	17.7	20.0	2.1	0.11	4.2
	20	Kenyon	35	VI S	57.0	30.6	12.4	6.8	30.9	31.1	2.6	0.12	8.0
	25	Lochiel	8	IX M	39.4	51.1	9.5	6.5	49.6	47.1	3.5	0.51	13.1
	34	Lochiel	38	VI M	61.7	31.5	6.8	6.8	23.8	24.5	1.3	0.18	4.4

APPENDIX TABLE 1 (Cont'd.)

Soil Type	Sample No.	Location			Sand % 1-.05 mm.	Silt % .05-.002 mm.	Clay % <.002 mm.	pH (glass electrode)	Cation Exchange Capacity m.e./100gms.	Exchangeable Cations			Organic Matter %
		Township	Lot	Con.						Calcium m.e./100gms.	Magnesium m.e./100gms.	Potassium m.e./100gms.	
Custer fine sandy loam	7	Charlottenburg	10	III	30.8	61.5	7.7	5.8	14.1	9.3	1.3	0.13	3.3
	8	Charlottenburg	17	IV	24.5	63.2	12.3	5.6	15.6	6.8	1.8	0.16	5.1
	41	Lancaster	27	I M	27.6	62.4	10.0	5.5	16.3	5.6	1.1	0.20	4.1
	52	Charlottenburg	28	V	25.0	69.0	6.0	5.7	13.2	4.7	0.9	0.09	6.4
	64	Lancaster	30	I S	26.9	66.4	6.7	6.6	16.7	13.0	2.4	0.07	4.6
	69	Charlottenburg	32	IV N	17.9	68.4	13.7	6.7	18.2	15.0	2.3	0.11	3.4
Bearbrook clay	1	Lochiel	32	II N	13.4	39.2	47.4	5.9	37.3	26.7	7.3	0.31	3.6
	2	Lochiel	11	II N	15.1	39.7	45.2	7.2	38.9	43.2	3.7	0.40	7.5
	21	Kenyon	41	IX S	15.7	43.3	41.0	7.2	42.3	45.8	4.5	0.41	6.7
	28	Lochiel	1	III M	19.6	36.4	44.4	5.6	25.3	10.9	5.6	0.51	4.2
	30	Kenyon	1	IX M	19.9	31.8	48.3	6.6	38.0	32.7	4.8	0.37	6.6
	71				31.7	28.7	39.6	6.0	36.2	21.2	6.8	0.51	5.3
Marionville silt loam	9	Charlottenburg	35	IV	17.6	62.1	20.3	6.0	20.6	17.1	3.1	0.15	4.0
	10	Charlottenburg	40	IV	20.3	66.9	12.8	6.0	13.5	10.2	1.8	0.18	4.0
	24	Lancaster	9	I S	32.1	54.1	13.8	5.2	17.8	7.6	2.7	0.21	6.3
	37	Lancaster	24	VII S	45.0	35.3	19.7	6.3	30.1	26.3	3.5	0.24	5.3
Matilda loam	17	Charlottenburg	36	X M	49.7	40.3	10.0	6.6	28.2	27.1	2.4	0.12	7.7
	49	Kenyon	37	IV N	61.0	28.7	10.3	6.3	21.6	18.5	1.8	0.75	5.3
North Gower clay	39	Lancaster	16	V M	20.1	55.1	24.8	6.2	26.9	22.4	4.1	0.21	4.5
	51	Charlottenburg	29	VII	16.0	61.4	22.6	7.0	38.3	41.5	1.9	0.25	6.6
	54	Charlottenburg	65	I N	45.4	39.0	15.8	5.8	23.9	16.1	3.3	0.29	4.2
	62	Lancaster	16	VIII M	18.2	57.4	24.4	6.6	35.0	29.7	3.5	0.24	6.1
St. Thomas fine sandy loam	12	Charlottenburg	14	IV	32.1	63.5	4.4	5.7	12.7	7.7	1.5	0.96	4.8
	59	Charlottenburg	11	III M	23.5	69.3	7.2	6.1	15.3	10.6	0.9	0.07	4.0
Woodstock clay	5	Lochiel	17	VI N	15.6	34.0	50.4	5.4	29.6	13.1	6.6	0.40	6.1
	6	Lochiel	8	VI N	18.8	32.2	49.0	6.0	41.2	29.8	9.5	0.57	9.1